Railway Mechanical Engineer

VOLUME 94, NUMBER 9. New York—SEPTEMBER, 1920—Chicago ESTABLISHED IN 1832

Published Monthly by Simmons-Boardman Publishing Co., Woolworth Building, New York, N. Y. Subscription Price, United States east of Mississippi, $3.00; west of Mississippi and Canada, $4.00 a year; foreign countries, $5.00 a year. Entered as second-class matter, January 27, 1916, at the post office at New York, N. Y., under the Act of March 3, 1879.

VOLUME 94 NO. 9

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Volume 94 September, 1920 No. 9

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Advance In Subscription Rates

To Our Readers:

The subscription rate to the *Railway Mechanical Engineer* on the basis of the number of editorial pages is the same today as it was a quarter of a century or more ago; this with the exception of an increase which was recently made to readers west of the Mississippi river, caused by the establishment of the excessive zone postal charges. Hereafter the subscription rate throughout the United States, Canada and Mexico will be $4. The rate to subscribers in other countries will be $5, and the price of a single copy will be 50 cents.

The publishing business, like the railroad and all other businesses, has been subjected to large increases in its costs of production. There are, however, special influences affecting the publishing business about which we feel our readers should be told. The white paper used by newspapers and periodicals, for instance, constitutes one of the largest items in their cost of production. During the first six months of the year 1920 the expenditures for paper for the *Railway Mechanical Engineer* and the other railway papers published by the Simmons-Boardman Publishing Company were *194 per cent* greater than in the first six months of 1919. This increase in cost was due only in a small degree to an increase in the amount of paper used. It was caused largely by advances in the prices that we have had to pay.

Even if the advance in the price of paper was the only advance in cost that we had to meet, it would be serious; but it by no means stands alone. During the first six months of 1920 the expense of typesetting, press work, binding and bulk postage of our railway papers was 125 per cent greater than in 1919. During the same period the increase in the cost of the engravings used as illustrations in our editorial pages was 265 per cent.

These statistics indicate the increases which have occurred in our "manufacturing costs." We have also been affected by the same influences which have compelled business concerns of all kinds to increase the wages and salaries of their employees. Publications of all kinds, owing to similar developments have been forced to advance their subscription rates. Metropolitan newspapers which formerly sold for one cent are now being sold for two and even three cents.

We are deeply appreciative of the loyal support which we have always received from our readers. It will be our endeavor in the future, as it has been in the past, constantly to make the *Railway Mechanical Engineer* a better paper, and we bespeak your continued cordial co-operation.

Roy V. Wright,
Editor.

The All-Round Railroad Man

It was once remarked by an able railroad executive that the successful railroad man was one who knew something about every branch of railroading and everything about one department. This is unquestionably true and the fact is undoubtless appreciated by many young men in railroad service. Is it not probable, however, that some of these young men are laboring under the impression that a general knowledge of each department is of the first importance and that the obvious

way in which to acquire an all-around knowledge of railway operation is to seek employment in various branches of the service by switching from one department to another as often as the opportunity presents itself? What the diversified tendency undertaken under a misguided notion may result in is well illustrated in the following reply recently received to an advertisement for a man having a good knowledge of railroading with some experience in the mechanical department: "I am an all-round railroad man experienced in all branches, viz, conductor, brakeman, fireman, engineer, track foreman, yard master, train master, despatcher, master mechanic, superintendent, maintenance of way, accountant, paymaster and detective." While the applicant further states that he can do anything desired, his proficiency in any line whatever would, of course, be seriously questioned. It would be well to bear in mind the fact that while executives have usually a surprisingly intimate knowledge of the conduct of every department, they have generally acquired this through keen observation and study in preference to the process of rotating from one department to another, which is often more demoralizing than helpful. Success depends so largely upon the tangible value of your services to your superior officers that a very thorough knowledge of just one feature may be put down as the most important single qualification.

Permanent Improvements to Cars

The railroads are bending their energies to getting the maximum mileage from all freight equipment. While the immediate necessity for more transportation justifies any measures that can be taken to meet the situation, the consequences may be serious unless the needs of the future are considered. There is no prospect that the amount of freight which the railroads are called on to handle will decrease. Cars which make unusually high mileage are sure to wear out with unusual rapidity and precautions must be taken to prevent cars being kept in service when in need of extensive repairs lest the roads find themselves at some future date handicapped by a large amount of freight equipment in a deteriorated condition.

The obvious remedy for this condition would be the immediate purchase of large amounts of new equipment, but with the present serious shortage of freight cars the existing equipment must be kept in service whether or not new cars are acquired.

While some roads have such a large proportion of bad order cars that no heavy repairs can be made with the existing forces and facilities, the roads that have reduced the bad order equipment to a reasonable percentage should put in effect a program for the reinforcing of equipment. This work should have for its object the elimination of all the troublesome defects that have developed in service. Not only should steel center sills or metal draft arms be applied where necessary, but the cars should be equipped with thicker end lining and steel end and corner posts or all steel ends. Roofs of substantial construction should be applied and the superstructure should be reinforced when necessary to avoid distorting the roof sheets. Side doors with steel frames and adequate door fixtures will eliminate many a damage claim and many a trip to the repair track. The trucks should not be overlooked; safety hangers for the brake beams should be applied where needed; side bars should receive attention; the weak truck bolsters should be replaced. The reduction of bad order cars to a maximum of 4 per cent is a praiseworthy object, but the emergency is not great enough to justify any road in meeting the situation by disregarding sound policies in the current maintainance of its car equipment.

Breaking Transportation Records

The fact that transportation is a limiting factor in the output of some of America's important industries has been stressed so often that it hardly needs emphasis. The difficulties of the early months of this year caused a falling off in the traffic handled, but with normal conditions restored the roads have been steadily increasing the amount of freight hauled. During the week of August 14, the number of cars loaded was 962,352, an increase of 129,913 cars over the corresponding week of 1919, and of 13,556 cars over the corresponding week of 1918. This is a new high record for this season of the year.

In order to better this, if possible, the Association of Railway Executives has set as a definite goal the following performance: 1—An average daily minimum movement of freight cars of not less than 30 miles per day; 2—An average loading of 30 tons per car; 3—Reduction of bad order cars to a maximum of 4 per cent of total owned; 4—An early and substantial reduction in the number of locomotives now unfit for service; 5—More effective efforts to bring about the return of cars to the owner roads.

Of these five factors which contribute to the operating efficiency, the third and fourth are matters for which the mechanical department is directly responsible.

The number of bad order cars is still very large and every effort must be made to get the cars into service. The roads should not hesitate to seek assistance from car building plants that may have excess capital available for repair work if they cannot reduce the percentage of bad order cars with their own forces. The report of locomotives out of service for repairs shows that the motive power on some roads is in excellent condition. Other roads have a high percentage of engines awaiting classified repairs. With labor available, the roads that are hampered by lack of serviceable power should add to the forces to improve conditions before winter weather increases the amount of maintenance work.

The Use of Micrometers

Are micrometer calipers an unnecessary refinement for railway shop work? Is it true that railway mechanics are not qualified to use any instrument more accurate than a two-foot rule? Both of these ideas have become so firmly imbedded in the minds of some people that it is difficult to dislodge them, but we feel that the correct answer to both questions is a decided "No." This belief is substantiated by the conclusions reached in an article entitled "Micrometer Calipers in Railway Shops" appearing elsewhere in this issue. The author of the article is a practical railway shop man of many years' experience, who maintains that the more general use of micrometer calipers will improve both the quality and quantity of shop output. Many important arguments are presented and detailed illustrations given to show how the use of micrometers on various classes of work will tend to produce the results predicted.

As an example of the way in which improved quality of work can be obtained the author cites the many force fits that must be made in locomotive repair work. It is pointed out that the safety of passengers and trainmen depends upon axle fits in wheel centers, which can be made most accurately when micrometer calipers are used in measuring. Some parts of locomotive motion work must be provided with running fits within certain limits. When these fits are too tight, the results are as serious as when too loose, and the exact amount of play, demonstrated by experience to be correct, can best be measured with micrometers. The use of micrometers in railway shops also makes possible more accurate measurements on many other classes of work. Mechanics can tell exactly how close they are working and

the results will be a general toning up and improvement in workmanship.

It was stated that shop output is increased in quantity, due to the fact that machine parts may be calipered more quickly with micrometers than with ordinary calipers and a scale. By having all measurements of similar work made by one man and recorded on suitable forms, machine operators can remain at their stations and thus reduce the idle machine hours. Micrometers also make possible greater accuracy in machining and therefore eliminate many scraping operations. For example, driving box brasses can be bored a limited amount larger than the journals and applied without further scraping or fitting, experience having demonstrated that no unsatisfactory results will follow. The reduction in the number of solid ring gages required, the tendency to eliminate disputes between inspectors and workmen and other important results of the use of micrometers are also pointed out in the article.

Fads and Facts About Fuel

Although staggering under an appalling fuel bill, how many railroads are making a consistent and persistent effort to reduce this bill, and how many of these have organized this effort on the same stable basis that characterizes the conduct of other departments? How many executives regard the fuel department as a fad, how many consider it a necessity? Nowhere will organized effort count for more than when directed towards fuel conservation on our railroads. But as long as supervision is regarded as a fad, so long will it remain a failure. If the management were dissatisfied with the operating department or with the mechanical department it is possible that they would make some change, but certainly they would not dispense with the organization even if that were practical. Yet every turn in the affairs of many railroads affects the mode of fuel supervision and fuel departments come and go as regularly as the tide. The railroads must consider fuel supervision as something more than a fad, they must organize this work on a sound basis and stick by the organization if they expect to stem the rising tide of fuel costs.

NEW BOOKS

Tin, Sheet Iron and Copper Plate Worker. By Leroy I. Blinn. 5 in. by 7 in., illustrated, bound in cloth. Published by Henry Carey Baird & Co., 2 West Forty-fifth street, New York.

This book can best be classed as a reference volume for engineers, foremen and mechanics who have to do with sheet metal working of any description. It could also be made use of as a text on this subject and will afford interesting reading to anyone versed in the manipulation of sheet metals, though it is primarily a handbook designed for the guidance of workers in sheet metal. As such it is eminently practical and deals most thoroughly with every phase of this work. Particular attention is given to the rules for laying out work of all descriptions, the composition of metallic alloys and solders, recipes for varnishes, lacquers, cements and so on. All the manipulations encountered in the work shop are described quite definitely. As this book is a revised edition of an earlier publication it may be added for the benefit of those who are familiar with the previous edition that the new edition contains all the fundamental subject matter appearing in the original publication, augmented by data on the modern system of triangulation as related particularly to skylight work. Moreover, the portion of the earlier edition treating on metallic alloys and solders has been entirely rewritten so as to incorporate the best modern practice. The subjects are systematically grouped and a complete alphabetical index adds to the value of the book as a reference volume.

COMMUNICATIONS

HANDHOLDS VS. WASHOUT PLUGS

Omaha, Nebr.

To the Editor:

Referring to the editorial Accidents Due to Washout Plugs, appearing in your January number and the articles by Mr. Lipetz and Mr. Grant in your April and June issues respectively pertaining to this subject.

The ordinary plugs in general use in this country were inherited from our very first locomotives which carried low boiler pressures and were built before the advent of the tube supported fire-box brick arches, which requires from 4 to 12 additional plugs, according to the width of the fire-box. The use of these plugs has been continued, probably due to the fact that they are simple and inexpensive in first cost, but it should be apparent to anyone familiar with the subject that they are inefficient and are not meeting modern service requirements. The final threads in the boiler sheets, being exposed when the plugs are removed, are subject to wear and damage by the insertion of the boiler washout implements. Further, the threads become clogged with dirt and scale from the boiler, resulting quite often in crossing the threads when the plugs are screwed in place.

When these plugs are located in the curved corners of the fire-box, usually not more than two full threads of the plug engage the sheets, and in order to obtain even this small number of threads the plug is limited to two inches in diameter and 12 threads per inch.

The Pennsylvania Railroad has used for a number of years, and to a considerable extent, handholds similar in general construction to those described by Mr. Lipetz, with the exception that they employ special asbestos gaskets instead of the lead gaskets. This type of handhold undoubtedly provides a more safe form of construction than the ordinary washout plug, but it is more troublesome to handle, and more costly.

Another type of construction which has been used to a limited extent in this country consists in flanging out and threading the fire-box sheets around the washout holes, and inserting the ordinary plugs, but this arrangement has practically all of the inherent defects of the ordinary plugs and the disadvantage that the sheets are materially reduced in thickness and weakened by the process of forming the flange as described.

Attention is invited to the form of washout plug illustrated by the accompanying sketch, which is self-explanatory and which was developed and patented by Messrs. Gilmore and Woodward, engineers of the American Locomotive Company.

The sketch shows the plug applied at the corner of the fire-box, but the same arrangement can be used on flat surfaces and for arch tube plugs. The square portion of the plug, provided for receiving the wrench, is shown extending outwardly, but it can be countersunk if desired into the outer end of the plug, thereby making the whole arrangement more compact.

It is understood that about 150 locomotives, built in this country, mostly for service abroad, have been equipped with these plugs, but I have no actual information as to how the plugs have met the service conditions.

With this plug the usual boiler cleaning tools could not damage the threads, nor could they become clogged with dirt from the boiler, and as relatively coarse threads could be used on the cap it is thought that little trouble should be experienced with crossed threads. It is simple in construc-

tion, should be reasonable in cost, and could be readily handled.

As accidents due to washout plugs are on the increase, and as it is generally admitted the plugs in common use are not meeting present-day conditions, the matter is of importance and it would seem that it should be given serious consideration by all concerned and especially by the committee on Design and Maintenance of Locomotive Boilers, of the American Railroad Association.

JOHN L. MOHUN,
Mechanical Asst. Union Pacific System.

FAIR PLAY FOR THE SERVICE OF SUPPLY

TO THE EDITOR:

Your editorial on the Service of Supply, appearing in the May issue of the *Railway Mechanical Engineer*, attracted my serious attention and I have read the subsequent correspondence which developed in connection with this editorial with more than usual interest.

It appears to me that in the first place much of the misunderstanding referred to between the mechanical and the stores department is in a large measure due to non-comprehension on the part of the mechanical department of the aim and purpose of the Service of Supply. This department fully appreciates that the mechanical department must have the material with which to work and it is never the purpose of the stores department to embarass the operation of the mechanical department by restricting the supplies of material furnished to this department. The quantity of these supplies is always limited by two very important factors; the availability of the material and the financial resources of the railroad. During times such as we have been passing through, it has often been exceedingly difficult to obtain the materials which are needed by our shops. This applies particularly to steel products of which there has been a great scarcity in many lines.

Unapplied material is money, and the purchase of material represents an investment. If the railroad can use this material as soon as it is delivered, it is a very profitable investment. But if the material lies around unused for months because the railroad has more of this particular kind of material than it needs, or because the mechanical department has changed its plans and has decided to use some other kind of material as frequently happens, then it is a very bad investment and, of course, the Service of Supply is blamed because it must continue to carry this material and absorb the loss due to the interest on the investment and the inevitable depreciation of the material which may be accelerated by obsolescence. But whether the investment be good or bad, it must invariably be proportioned to the financial resources of the railroad. There are many things that you need, both in your business and in your home, things that, if purchased, would save you a great deal of money or increase the enjoyment of your home, but if you do not have the money, you must forgo their purchase. This is frequently the situation in which the railroad finds itself and not unfrequently it is the Service of Supply that is blamed by those who have asked for the material.

One of your correspondents has, if I have not misunderstood him, suggested that the railroad should proceed with the purchase of needed material without regard to its financial resources and depend upon its enhanced earning capacity to create the necessary credit. If matters were as simple as this there would have been no occasion for the railroads to plead poverty before the Interstate Commerce Commission or any real necessity for the recent rate increases to correct a situation that has been fundamentally responsible for the inability of the railroads to properly provide for their needs.

There is, of course, another factor to be reckoned with in any consideration of this subject and that is the efficiency of this much abused Service of Supply. This has an all important bearing on delays to equipment undergoing repairs; which, after all, is what the mechanical department is most concerned about. A simple statement of the facts will serve to illustrate my point and possibly convince some of the mechanical fraternity that what is really needed on every railroad is a strongly organized Service of Supply and that this is the best possible insurance against delays attributable to shortage of material.

"During the period of federal control, the inspectors of the mechanical division were instructed to report to headquarters all shop delays with their cause and duration. All delays attributable to shortage of material were at once reported to the Division of Purchases and were immediately investigated thoroughly on the ground and the conditions remedied. Out of scores of such reports received from all over the country, indiscriminately, only one report referred to conditions on a railroad which has had a properly organized supply department operating for any length of time."

GENERAL STOREKEEPER.

STANDARD METHOD OF PACKING JOURNAL BOXES

TOPEKA, Kan.

TO THE EDITOR:

There were two elements in the discussion of the use of the front plug in the journal box at the A. R. A. Convention that apparently were overlooked. First, the figures quoted on the increased car miles obtained per hot box by leaving out the end plug compared a period when all boxes were repacked with a period when the journal boxes ran until they gave trouble or the car was sent to the shop for repairs. These two periods are not comparable. Second, approximately 40 per cent of all hot boxes have other troubles than poor packing as the cause of their running hot. If the car trucks were given attention many of these defects would be automatically rectified.

The only use of journal box packing is to lubricate the journal. The absorbent power as well as the capillary power of the waste are the only qualities that directly affect the lubricating capacity of the waste. Resilience is an important mechanical characteristics of any good journal box packing. Two journal boxes with equal qualities of waste and packed in the same manner will give equally satisfactory service, other conditions being equal. The condition of the packing under the journal is the essential thing. The use or non-use of a plug in the end of the box does not affect the lubrication of the journal until some other condition obtains. If no end plug is used in the box the packing must be set up each trip or each division. If a plug is used the box will run a much longer time without any attention. It is a question of labor pitted against the plug.

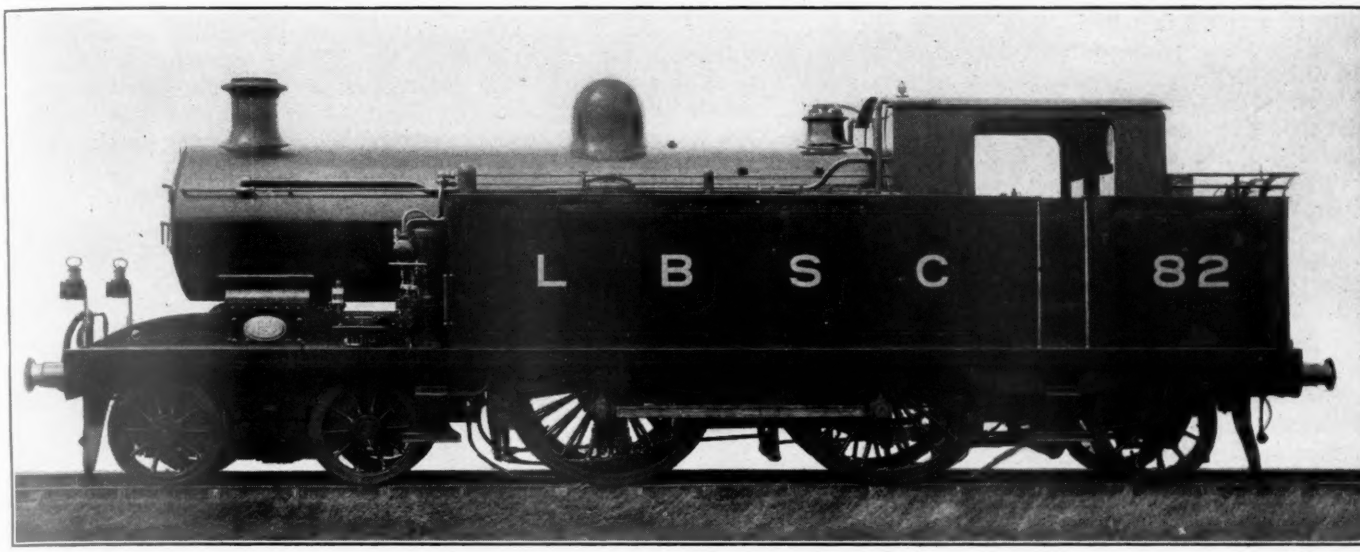
Briefly, the arguments for and against the use of the end plug are as follows:

Arguments Against the Use of the Plug. 1. The box can be better inspected without the plug. 2. The saving of material by leaving the plug out.

Arguments for the Use of the Plug. 1. The plug holds the packing under the journal if properly applied. 2. The plug is an additional oil storage for the lubrication of the journal. 3. The plug will assist in keeping dust from the packing underneath the journal.

If all journal boxes were repacked periodically the packing should always be in good condition and there would not be so much hot box trouble. This repacking must be done in a conscientious and thorough manner to accomplish the desired results.

H. L. SHIPMAN.



One of 42 English Tank Locomotives Equipped with Feed Water Heater as Detailed in Fig. 8

Locomotive Feed Water Heating in Europe

The High Price of Coal Has Stimulated the Use of This Appliance; Over 10,000 Units in Operation

BY ROBERT E. THAYER

European Editor of The Railway Mechanical Engineer

With the present cost of coal anywhere from 200 to 1,600 per cent of what it was before the war, the railways of Europe have been forced to consider very carefully means by which locomotives can be operated with a decrease in fuel consumption. Superheating is, of course, quite universally adopted although in England this method of saving fuel has not been developed to the same extent as on the railways in the United States. The use of feedwater heaters is one means of fuel economy which is now receiving the greatest attention particularly on the Continent. It is estimated that there are over 10,000 feedwater heaters in use on the railways of Europe. These are distributed amongst the Weir system, the Caille-Potonie system and the Knorr system, the latter having by far the greatest distribution. The Weir system is confined almost entirely to Great Britain, the Caille-Potonie to France and the Knorr to Germany, Holland and Switzerland.

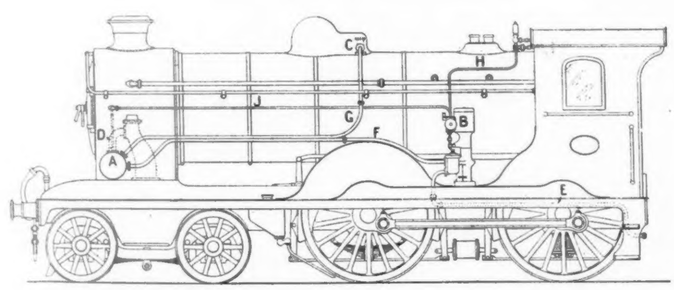


Fig. 1—Arrangement of Weir System of Feedwater Heating

The Weir System

The Weir system of feedwater heating consists of a double-acting steam feed pump which takes the water cold from the tender through the pipe *E* forcing it through the heater *A* into the boiler through the discharge pipe *G* as shown in Fig. 1. The pump is of a vertical type and is of a design largely used in marine service. The heater is shown diagrammatically in Fig. 2. It consists of a bundle of tubes of solid drawn copper expanded into tube plates *E* of rolled brass. These tube plates are fixed to the ends of a mild steel shell by collar bolts which also carry the end covers of the heater. The covers contain dividing ribs which cause the feed water to flow from end to end of the heater, making four passes. The exhaust steam from the cylinders enters the heater at *B* and from the pump at *C*. Thus it will be seen that the exhaust steam surrounds the tubes and with the feed pump between the heater and the tank the heater is subjected to boiler pressure.

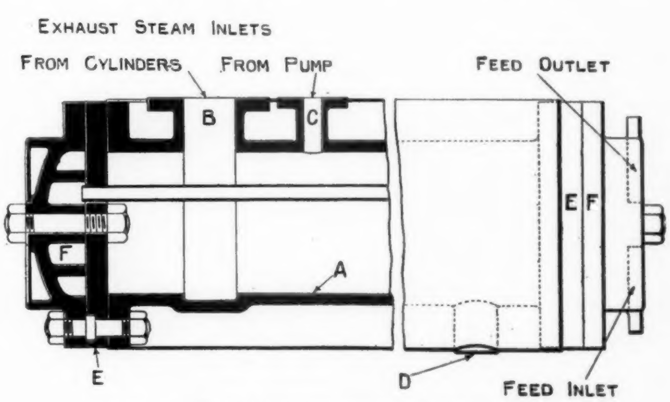


Fig. 2—Weir Locomotive Feedwater Heater

The Caille-Potonie System

The Caille-Potonie system is of the open type, the water flowing from the tank to the feed water heater by gravity, a hot water pump being used to take the heated water from the heater and pump it into the boiler. A diagrammatic out-

line of a recent installation is shown in Fig. 3. The water from the tender passes through the pipe *M* to the "Y" fitting *P* which delivers the water to the top and bottom of the heater. The heated water is taken off at *J* passing through the pipe *Q* to the pump *S*. From there it passes through the pipe *T* to a check valve and into the boiler.

The exhaust steam for heating the feed water is taken from the exhaust nozzle *A* passing through the pipe *C* to the heater. The exhaust from the feed pump also passes to the heater through pipe *X*. The amount of exhaust steam to be taken from the exhaust pipe is regulated by a deflector valve which is set to deflect the proper amount of steam to the heater. The heater itself is kept at atmospheric pressure, a pipe R extending up from the top of the heater to above the water line in the tender. This not only provides a means of overflow for the heater but also permits the air and gas formed in heating the water to escape. A spring regulator valve is shown at *D*. This is placed in the pipe *C* between the heater and the exhaust pipes and is so regulated that when the pressure of the exhaust steam in pipe *C* exceeds a predetermined amount the supply of exhaust steam to the heater is reduced. Its purpose is to prevent the feed water in the heater being raised to too great a temperature for the pump to handle. The pump, however, is designed to handle water with a temperature of 209 deg. F. without a loss in its efficiency. As the temperature in the feed water heater increases the pressure of the exhaust steam in pipe

the tubes and the exhaust steam passes through them. Entering at *A*, it makes three passes through the heater, the condensed water passing out through the bottom at *B* and on to the track. The heater is provided with a settling basin which catches the precipitation of any scale forming matter

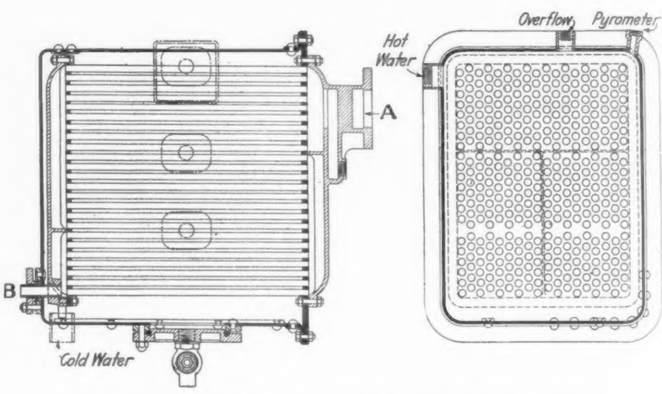


Fig. 4—Caille-Potonie Locomotive Feedwater Heater

as the water is heated. This basin has a cleaning hole as indicated in the drawing by means of which it can be cleaned every 400 or 500 miles depending upon the character of the water handled. The hot water steam pump in this system

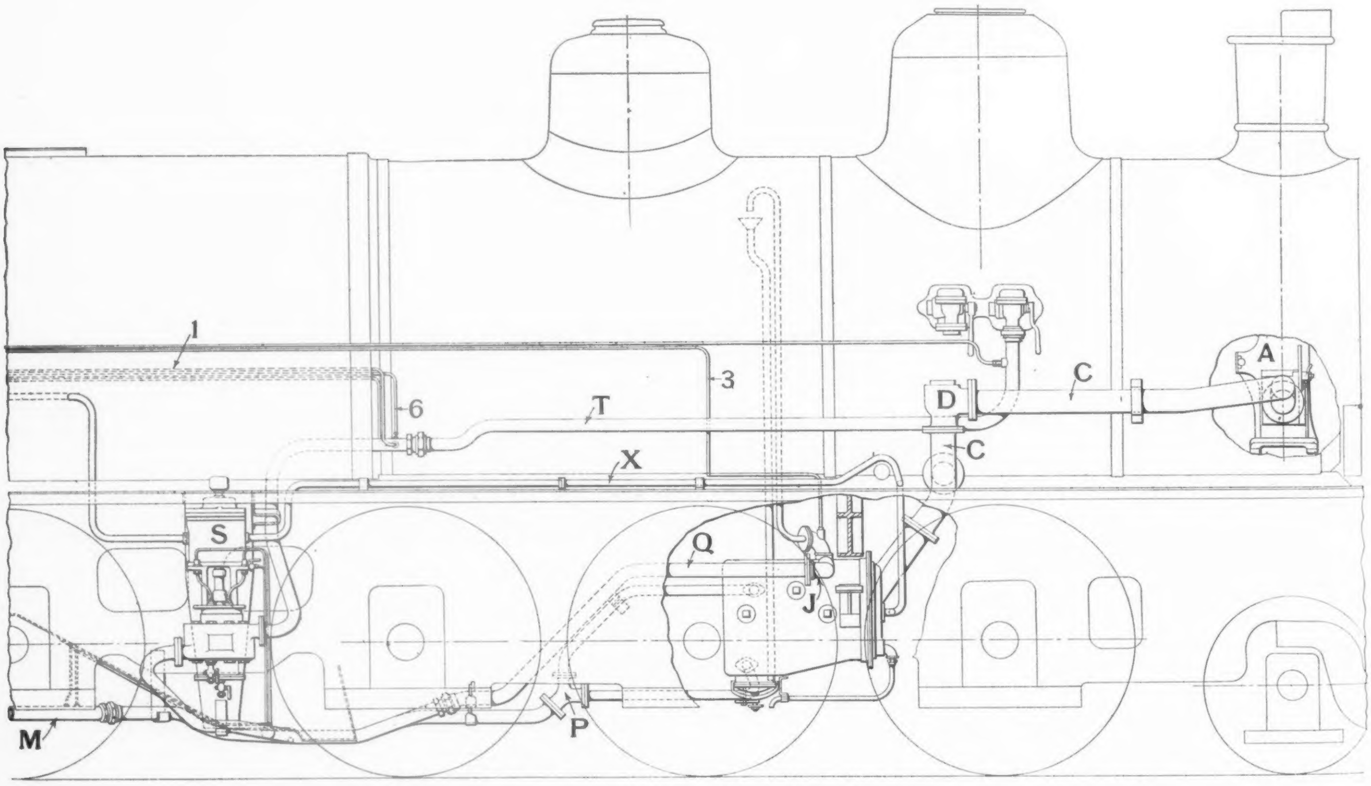


Fig. 3—Arrangement of the Caille-Potonie System of Feedwater Heating

C increases and overcomes the spring of the regulator valve and thus reduce the supply of the exhaust steam to the heater. A pyrometer is placed in the heater discharge pipe, the wires of which pass through the conduit *3* to a gage in the cab. A connection is made in the delivery pipe *T* and piped through *I* back to the cab to a gage which indicates the pressure of the feed water in the delivery pipe. Another connection is made in the delivery pipe for sprinkling the coal in the tender, the water passing up pipe *6* back to a tap in the cab.

The heater itself is shown in Fig. 4. The water surrounds

is located on a level with the feed water heater in order to reduce the lift to a minimum.

The Knorr System

The Knorr system operates with the heater under pressure, the pump being placed between the heater and the tank. Fig. 5 shows the general arrangement of this system. Water from the tender passes to the pump *M* and from there to the heater *A*. being delivered from there to the boiler through pipe *F*. The exhaust steam is taken from the exhaust passages of the cylinder castings at *G* passing through

the pipe J to the heater. Exhaust steam from the air pump passes into the heater through the pipe L and the exhaust steam from the feed water pump passes to the heater through the pipe K. The condensate from the heater passes to the track through the pipe R. An oil pump for lubricating the

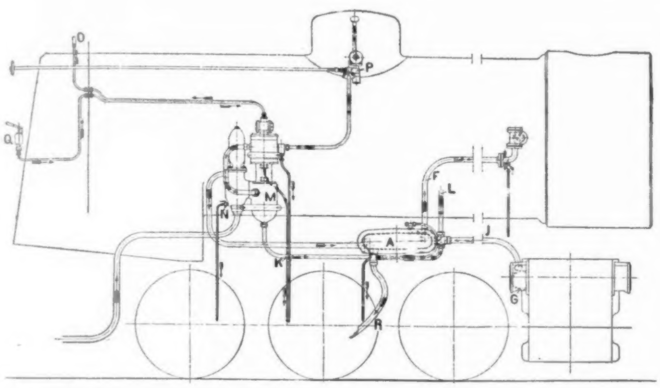


Fig. 5—Arrangement of Knorr System of Feedwater Heating

feed water pump is shown at Q and O is a counter registering the number of the strokes of the feed pump. At P is located the steam valve for operating the feed pump. This is controlled, as indicated, from the cab.

This diagram shows a flat feed water heater which is one of the earlier types made but the present standard heater is circular in shape as shown in Fig 6. Also the condensate

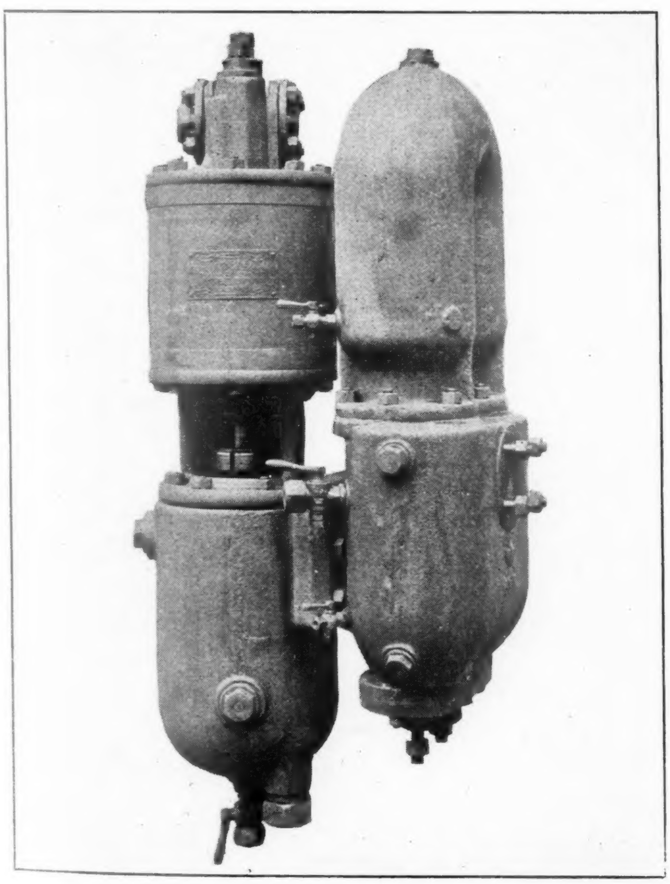


Fig. 6—Knorr Locomotive Feedwater Pump

is shown as being discharged on to the track. More recent installations are arranged for the condensate and steam passing through the heater to discharge into the ashpan. This diagram also shows exhaust steam being taken from the exhaust passages in each cylinder but there are installations which take the exhaust steam directly from the exhaust pipe.

The heater as shown in Fig 6 consists of a bundle of U-pipes which are held in only one tube plate. The water passes through these tubes making four passes, and the exhaust steam surrounds them. The water enters the heater at A and is discharged at B. The exhaust steam enters at CC and the condensate flows out at D. The construction of this heater is such that all of the tubes can be removed intact with tube plate when it is desired. All of the tubes are bent to the same radius and are interchangeable. Any individual tube can be removed and replaced although it will be shortened by the length of its former bearing in the tube plate. With bad water difficulty is experienced in keeping these tubes clean on account of the U-shaped ends.

Development in England

In England but little has been done recently although there is a tendency to seriously consider the application of feed water heaters to locomotives on account of the increase in the cost of fuel. The cost of locomotive coal has increased about 100 and 120 per cent. Almost every road has at some time or other done some experimenting—usually before the war. However at the present time but few locomotives are equipped. Out of twelve railroads, five have none installed, one road has one, two have two, one has five, one has fifty-three and two have some but the number was not stated.

Following are quotations from some of the replies to a letter of inquiry on this subject:

Road A—Our experience with locomotive feed water heaters has been limited to two installations. The results have been satisfactory, there being about 8 per cent saving in coal and 5 per cent in water.

Road B—We equipped five locomotives with feed water heaters in 1912. They are still in service and do not give any particular trouble. However the slight saving obtained

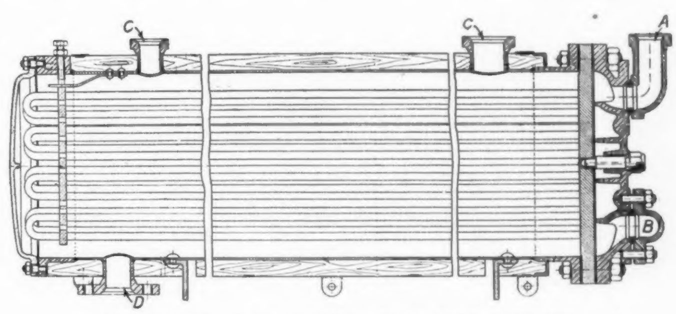


Fig. 7—Knorr Locomotive Feed Water Heater

does not cover interest and depreciation on the first cost, together with repairs.

Road C—We have one locomotive fitted with a feed water heater. In the January, 1914, some tests were made with our dynamometer car while the engine was hauling a passenger train in one direction and a freight train in the opposite direction. There was no appreciable difference between the injectors we are at present using and the feed water heater as fitted.

Road D—Fig. 7 shows a 4-4-2 type side tank passenger engine fitted with a feed water heater. Exhaust steam from the cylinders is admitted to the water tanks through the pipe A, the flow of which is controlled by a butterfly valve located at B and operated from the footplate. The temperature of the water is thereby rapidly raised, and as the hottest stratum lies at the top it is drawn off through the tubes C adjusted to the water level by a copper float, which is hinged at D thus allowing water to be taken at all levels by means of the "Weir" feed pump E and delivered

to the boiler through an ordinary check valve *F* at an approximate temperature of 180 degs. F. This pump can be set to discharge into the boiler just as much water as is being evaporated and is capable of going very slowly without actually stopping. It is driven by steam and the exhaust is utilized to heat the water in the tanks through pipe *G*. A supplementary heating ejector *H* is also fitted and takes steam from the boiler by means of the steam valve I. This is used to heat the water when the engine is being prepared for its day's work, and after it has generated sufficient steam. It is also used in turning the surplus steam into the tanks when the fixed boiler pressure is exceeded, and steam is being blown off at the safety valves. This railroad has 42 engines fitted in this manner.

A similar arrangement of feed water heating is used on ten 4-4-2 tank engines, but in this case the delivery from the feed pump is taken to the check valve *F* fitted on a feed dome on the top of the boiler (Fig. 8). The water at a temperature of approximately 180 degs. *F* enters a closed drum at the center of the feed dome and clear of the delivery pipes *LL*, these being placed at the sides. As the drum fills the water overflows into the delivery pipes *LL* and passes into the boiler. The drum is made deep so that the sediment may be deposited at a sufficient depth from the mouth of the delivery pipes, as it has been found in the shallow domes that, owing to the velocity of delivery, a great bulk of the sediment is carried over into the boiler. A shield plate *M* is fitted over the steam pipe and as the water falls onto it from the pipes *LL* it divides into streams which allows it to attain very quickly a temperature equal to that in the boiler. This arrangement has given entire satisfaction.

Road E—We have for many years used the exhaust steam injector, the economy from the use of which we estimate to be between 8 and 10 per cent of coal.

Feed Water Heating in France

The principal source of information regarding the development of locomotive feed water heating on French railroads was obtained from the manufacturers of the Caille-Potonie System. There are 146 of this type of heater in use, with 272 on order in France itself. There are 20 in Tunis, 8 in Belgium, 50 in Roumania and 3 in Turkey. *Recent tests made by a prominent French road with the apparatus shown in Figs. 3 and 4 have shown a fuel saving of 17.8 per cent in fuel consumption per 100 ton-kilometers over the same locomotive using the injector and there was an increase of 22.3 per cent in evaporation.*

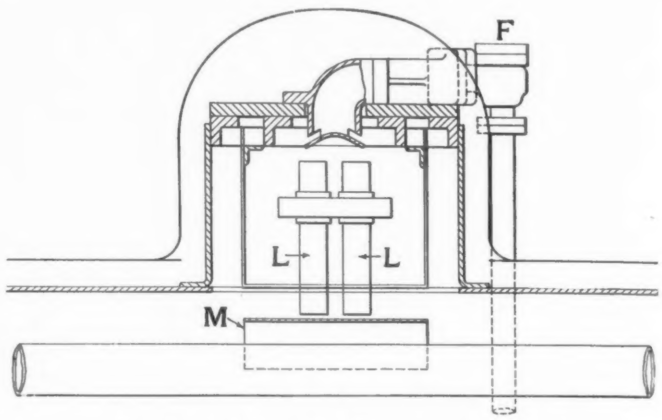


Fig. 9—Feed Dome for Feedwater Delivery

The cost of locomotive coal in France has risen over 700 per cent and there has been a manifest interest in feed water heating as shown by the large number of feed water heaters on order.

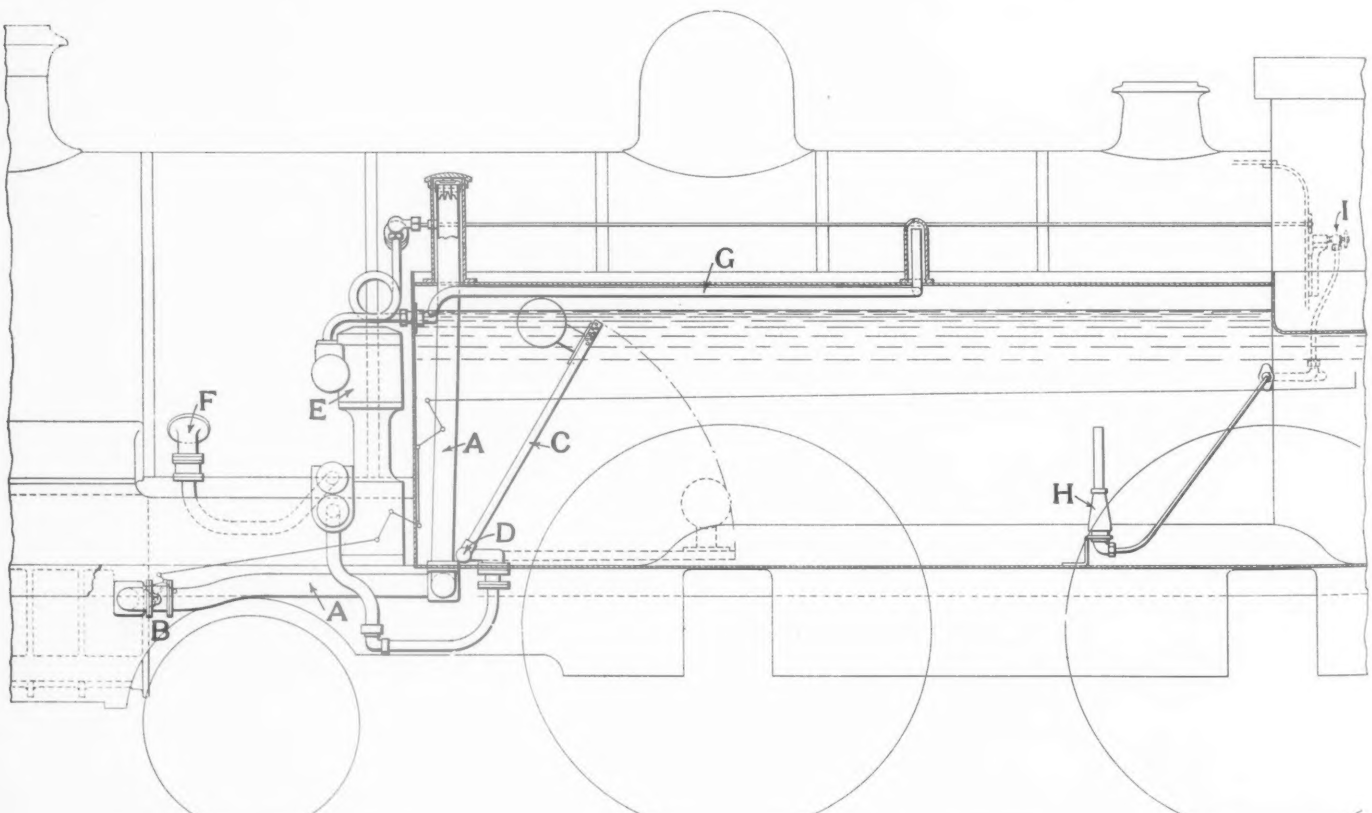


Fig. 8—Feedwater Heating Apparatus as Applied to English Tank Locomotive

Feed Water Heating in Belgium

The following abstract of a letter from Belgium indicates clearly the situation there.

Before the war we had decided to experiment with various systems of feed water heaters. Our object was not so much to find out what economy could be effected by the use of pre-heaters to a locomotive—the importance of which economy is incontestable—as to compare the systems in question from the point of view of efficacy, smooth working and upkeep. The war prevented us going on with the matter.

Among the locomotives supplied to us by the Germans in virtue of the terms of the armistice, a fairly large number are fitted up with the Knorr heaters. The present condition of the service has not permitted us to try experiments with a view to determining the economies resulting from its use. The Knorr apparatus has caused a certain number of mishaps specially affecting the heater tubes. At the beginning some difficulties were met with on account of the inexperience of the staff, but these have now disappeared.

With the view to making comparisons we have also decided to fit feed water heaters to some of the locomotives which are at present in the course of construction. Ten of the Consolidation locomotives which are ordered from England will be fitted with the "Weir" heater and five of the Consolidated locomotives ordered from America will be fitted with the "Worthington" heater.

Feed Water Heaters in Holland

The railways of Holland have also a "coal problem." The price of locomotive coal has increased about 1,200 per cent from since before the war, and locomotive feed water heating has become very popular. This country uses the Knorr system entirely. There are about 300 locomotives out of a total of about 1,000, that are equipped and the present program calls for the application of heaters to all of the principal locomotives. This includes locomotives weighing from below 50 tons to the heaviest locomotive of 102 tons. The railways in Holland have made no conclusive tests with the feed water heater but it is claimed that a feed temperature of from 190 to 210 degs. F. is obtained.

Feed Water Heating in Switzerland

The situation in Switzerland is well outlined in the following abstract of a letter from the chief mechanical engineer of the Swiss Federal railways:

The first experiment with locomotive feed water heaters on the Swiss Federal railways was undertaken on a new 4-cylinder simple, superheated locomotive, which was put into service at the end of 1913. The locomotive was fitted with an exhaust steam and smoke box heater in conjunction with a Westinghouse feed pump. This experiment was not satisfactory; the exhaust heater was much too small, it required much repairing on account of faulty construction, the smoke box heater hindered the passage of gases so much that to obtain a sufficient head of steam about half the tubes of this heater had to be removed, so that the heating surface was reduced from the original 253 sq. ft. to 134 sq. ft. This feed heater also required much repairing, as the thin tubes became bent and cracks appeared in them. In 1915, therefore, both feed-heaters were removed, the exhaust heater with the feed pump being applied to a smaller superheated compound locomotive for which it is suitable.

At the beginning of 1915 two new superheated compound locomotives were put into service with exhaust feed heaters; one locomotive was fitted with a Westinghouse feed pump and a feed heater from the Winterthur Locomotive Works, the other with a Knorr feed pump and Knorr feed heater. Both arrangements have proved successful.

On the trial runs, which were carried out on the section Erstfeld-Göschenen (Gotthard railway), with a continuous ascent of 2.5 and 2.6 per cent, *a saving in coal of about 10 per cent per 100 ton-kilometer was established for engines with feed heater in comparison with engines of similar construction without feed heater.* The performance of the engines have been improved quite considerably in consequence of the installment of feed heaters. Therefore the 15 superheated compound locomotives delivered in 1916 and 1917 have all been fitted with exhaust feed heaters, and feed pumps. Old Westinghouse air pumps have been used, with their air-cylinders replaced by water cylinders in conjunction with a suction chamber. In the meantime, for the remaining 11 superheated compound locomotives feed heaters of the Knorr pattern have been ordered.

It has been found that the saving from feed heating on locomotives traveling chiefly on lines with alternately rising and falling gradients is small. The feed heaters are only suited for long sections which are run under steam.

There are in all up to the present 21 locomotives already provided with feed heaters and 11 others are shortly to be fitted with them.

Development in Germany

Locomotive feed water heating in Germany is now as common as superheating in the United States. It is estimated that there are over 10,000 locomotives so equipped. It is not an after-the-war development there, for as early as 1909 the German railways began investigations and installations on a large scale were made soon after that. The Knorr system was adopted as standard and by the end of 1912 about 3,000 heaters were installed. At the present time there are well over 10,000 in operation and they are being applied at the rate of 2,000 a year. All new locomotives are equipped with this device and many old locomotives. With coal costing 200 marks now, as against a price of 12.5 marks before the war, it is estimated that the feed water heaters pay for themselves through the economies effected in less than one year.

The only test data available in regard to this system of feed water heating are the results of tests made in 1913 on a passenger locomotive (Type 2-B) over a distance of 91 miles between Grunewald, just outside of Berlin, and Gusten. Three tests were made, one without the heater—Test A—one with the heater—Test B—under the same conditions as test A, and the third—Test C—with the heater and a heavier train. During test C two more stops were made than in test A and B, but notwithstanding this fact the running time of test C was less than either tests A or B. The following table gives a summary of the results of these tests:

	Test A	Test B	Test C	Percentage Difference B over A	Percentage Difference C over A
Feed water heater	No	Yes	Yes		
Running time (min.)	129	131	125	1.5	—3.1
Train load (tons)	348	348	353	...	1.4
Coal consumption (lb.)	5,672	4,300	5,400	—24.3	—4.8
Ton-miles per lb of coal	5.59	7.37	5.95	31.8	6.4
Water consumption (lb.)	31,000	31,900	36,100	9.2	16.4
Evaporation	5.45	7.42	6.68	36.1	22.6
Coal per sq. ft. of grate area per hr. (lb.)	108.5	80.9	106.5	—25.4	—1.8

It will be observed that there is a decided increase in the efficiency of the locomotive in Test B over that in Test A, although the same load was hauled. Test C indicates that even a heavier load can be hauled when the feed water heater is used, with a decrease in fuel consumption and an increase in evaporative efficiency, than when the heater is not used.

The service rendered by the heaters has done much to relieve the severe locomotive shortage the German railways experienced after the war. In a paper before the Verein Deutscher Machinen-Ingenieure in December, 1912, Gustav Hammer, who is now the chief locomotive engineer of the Prussian-Hessian System, said that the principal reasons for the rapid introduction of feed water heating by exhaust steam are the greater economy obtained by the saving of coal and the increase of efficiency without the weight of the en-

gines being increased much. The greatest economy in coal is naturally obtained with engines having the highest steam consumption and such engines cause a heavy strain on the boiler. The economical results obtained are not only due to the fact that a large amount of the heat from the exhaust steam is reclaimed, but also because it reduces the rate at which the fuel is burned on the grate. Both of these factors increase the efficiency of the boiler. *According to the conditions of the traffic the saving of coal varies, but, on an average, it may at least be 10 per cent.*

More important still is the increase of the efficiency of the engine as a whole. If the friction weight and the efficiency of the machine are sufficient and only that of the boiler fails this can be quite considerably increased by feed water heating. This is especially important for lines the permanent way and bridges of which do not allow a special increase of wheel loads. The tests of the Royal Railway Central Office, which were very thorough, have shown increases of the efficiency of the boilers of 20 per cent and more, in a way that cannot be disproved. In particular, these tests have shown that, with superheated steam engines, under otherwise identical circumstances, the production of steam can be increased from 12.5 lb. to 15.4 lb. per sq. ft. per hour by exhaust steam heating.

The preservation of the boiler is to be considered as a further very great advantage of the feed water heating. This preservation is, first of all, brought about by the smaller heating surface required with the same efficiency in comparison with the ordinary engine as about 1/6 of the heat contained in the exhaust steam is regained. It further results from the difference in the feeding of the boiler as well. When using the heater, the supply of feed water must be adapted to the consumption as exactly as possible. It is not an intermittent feeding, but a continuous one by the steam feed water pump, which can be adjusted very easily, and within any limits. It is not the same with the injector. Furthermore, the boiler is supplied with water at a lower temperature with the injector than with the heater. The boilers properly fed with heated water must be considerably better and have a greater life than those fed with injectors only.

MOUNTAIN TYPE FREIGHT LOCOMOTIVES FOR THE SOUTH AFRICAN RAILWAYS

While it is true that locomotives built in accordance with American practice have demonstrated their fitness for service in all parts of the world, there are many railways which, for good and sufficient reasons, when purchasing locomotives from builders in the United States, specify that European designs be followed. American builders have had considerable experience in work of this kind, even to the extent of building locomotives throughout to the metric system of measurement.

The Baldwin Locomotive works have recently constructed thirty locomotives for the South African Railways, built throughout in accordance with the railways' designs and specifications. The South African lines are built to a gage of 3 ft. 6 in., and in view of the narrow gage and clearance limits, the motive power is conspicuous because of its exceptional weight and capacity. The new locomotives are of the 4-8-2 type, and the average weight carried per pair of coupled wheels is very nearly 38,000 lb. The tractive effort is 41,700 lb., which compares favorably with the motive power used on standard gage lines in the United States.

Locomotives of this general design have been in service on the South African Railways for some time, working between the Witbank coal fields and Johannesburg, hauling trains of 1,400 tons over this 80-mile stretch of track, the maximum grades being 1 per cent. The locomotives are designed to traverse curves of 300 ft. radius.

The new Baldwin engines have straight top boilers, with wide fireboxes of the Belpaire type. The inside firebox plates are of copper, a material which has given excellent service results in this district, where the water used is of exceptionally poor quality. A fire-tube superheater is installed, and the steam temperatures are indicated by the permanent installation of an electric pyrometer.

The frames are of the plate type, which were shipped completely assembled with cross-ties, cylinder saddle, cylinders, guides and guide yoke. The pistons were in the cylinders, and the cross-heads in the guides. This type of subassembly makes for considerable convenience in the final erection.

The equipment of these locomotives includes American steam brakes on the coupled wheels, and automatic vacuum brakes on the tender, with train connections. The special equipment includes Hasler speed recorders and a power operated grate shaker. On the right hand side of this locomotive is located a combination steam and hydraulic reverse mechanism, connected directly to the reversing shaft of the locomotive. This mechanism consists of one steam cylinder and one water cylinder. The two cylinder pistons are connected to a common piston rod, which in turn is fastened to the reverse shaft arm. The water cylinder is simply a cylinder with passages from one end to the other, and is entirely filled with water. This cylinder acts as a locking device for the holding of the reverse shaft in a desired position. The steam cylinder is used for moving the reverse shaft and at the same time causing the water piston to move it. When the steam valve in the cab is closed, the steam ceases to function and the water cylinder, by having equal pressure on both sides of the piston holds the gear in the proper position.

General Data

Gage	3 ft. 6 in.
Service	Freight
Fuel	Coal
Tractive effort	41,700 lb.
Weight in working order	205,100 lb.
Weight on drivers	151,900 lb.
Weight on leading truck	27,200 lb.
Weight on trailing truck	26,000 lb.
Weight of engine and tender in working order	310,000 lb.
Wheel base, driving	13 ft. 6 in.
Wheel base, total	31 ft. 9½ in.
Wheel base, engine and tender	57 ft. 7⅜ in.

Ratios

Weight on drivers ÷ tractive effort	3.64

Cylinders

Kind	
Diameter and stroke	22½ in. by 26 in.

Valves

Kind	Piston
Diameter	11 in.

Wheels

Driving, diameter over tires	51 in.
Driving, thickness of tires	3 in.
Driving journals, main, diameter and length	9 in. by 10½ in.
Driving journals, others, diameter and length	8½ in. by 10½ in.
Engine truck wheels, diameter	28½ in.
Engine truck, journals	5½ in. by 8½ in.
Trailing truck wheels, diameter	33 in.
Trailing truck, journals	5½ in. by 11 in.

Boiler

Style	Straight top
Working pressure	190 lb. per sq. in.
Outside diameter of first ring	69 in.
Firebox, length and width	88 in. by 65⅛ in.
Firebox plates, thickness	$\frac{9}{16}$ in.
Firebox, water space	3 in.
Tubes, number and outside diameter	139—2¼ in.
Flues, number, and outside diameter	24—5½ in.
Tubes and flues, length	20 ft., 1⅞ in.
Heating surface, tubes and flues	2,338 sq. ft.
Heating surface, firebox	158 sq. ft.
Heating surface, total	2,496 sq. ft.
Superheater, heating surface	532 sq. ft.
Equivalent heating surface*	3,294 sq. ft.
Grate area	39.9 sq. ft.

Tender

Weight	104,900 lb.
Wheels, diameter	33½ in.
Journals, diameter and length	5½ in. by 10⅛ in.
Water capacity	5,100 gal.
Coal capacity	8 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

GOVERNMENT TESTS OF WATER-INDICATING DEVICES

Tests Demonstrate Unreliability of Many Water Indicating Appliances on Modern Locomotives *

THE development of the locomotive has created new difficulties in design, construction, maintenance and operation. One of the perplexing problems which has presented itself is that of securing a correct indication of the height of water over the crown sheet under all conditions of service.

The grave importance of this matter is evidenced by the number of crown sheets damaged, due to low water, where careful investigation fails to disclose any contributory cause.

In the locomotive boiler, which usually has a sloping back head and is generally equipped with arch tubes and brick arch, the heat is severely impinged on the door sheet and back end of crown sheet, creating severe agitation and rapid circulation up the back head and through the arch tubes. The water glasses and gage cocks, as generally applied, only indicate a corresponding level of water while the locomotive is at rest and with no steam escaping. When the safety valves lift or with the throttle valve open and the locomotive in operation, the gage cocks, when applied directly in the boiler, indicate a higher level of water than do the water glasses when they are properly applied and maintained. This discrepancy between the registrations of these devices has heretofore, been taken as a matter of natural consequence, and little consideration given to the cause or the result of the conflicting registrations.

Practically all enginemen and others having to do with the operation of the locomotive, true to a common understanding, believe that the correct height of water over the crown sheet is always indicated by the gage cocks, and that the level indicated by the water glass is unreliable and not to be depended upon; therefore it is reasonable to believe that enginemen have frequently depended upon a level of water indicated by the gage cocks as being correct, when in fact the true level was much lower, and, as a consequence, damaged crown sheets have resulted.

Realizing that this variation creates an unsafe condition and that its cause should be determined and a remedy applied, experiments have been made with different devices, on a number of locomotives of different classes, on fourteen railroads in various sections of the country, for the purpose of determining the action of the water in the boiler and its effect upon the gage cocks and water glasses.

Excerpts from tests made on five railroads on which the most extensive tests were conducted will serve to briefly describe the surprising conditions disclosed. During all of these tests and observations, representatives of the Bureau of Locomotive Inspection were accompanied and ably assisted by representatives from the mechanical department of the various railroads.

Summary of Tests

The locomotives on which the first series of tests was made were of the 2-8-8-2 mallet compound type, used in bad-water districts, equipped with boilers of the crown bar type, with wide fireboxes and Schmidt superheaters, and used oil for fuel. The devices for indicating the water level consisted of three gage cocks spaced 3 inches apart and applied directly in the back head near the knuckle, at right angles to the sloping sheet, and one water glass with bottom connection entering the back head approximately 3 inches below the back end of the crown sheet, and the top connection entering the back head 2 inches below the knuckle. The lowest reading of the water glass and gage cocks was 3⅝ in. above the highest part of the crown sheet.

The back heads of these boilers were braced by a "T" iron, extending crosswise, at approximately the same level as the back end of the crown sheet.

In order to determine the action of the water as indicated by these appliances, observations were made during five trips in freight service, covering a distance of 680 miles, under varying operating conditions and on varying gradients.

With the locomotive on straight track and no indication of foaming, water would issue from the top gage cock when it was opened, both while standing and in operation, while the safety valves were open or the throttle valve open, regardless of the water level in the boiler as registered by the water glass.

At the completion of the fifth trip, three additional gage cocks were applied in the back head, parallel with the horizontal center line of the boiler, the top one entering the back head 10½ in. below the top knuckle and 10½ in. to the right of the vertical center line, with the same vertical reading as the standard application, and will hereafter be known as "experimental gage cocks." These were applied for the purpose of determining the effect of changing their location toward the vertical center line of the back head and away from the knuckle, where the upward circulation of the water was believed to be greater than near the center.

An experimental water glass was also applied on the left side of the boiler, opposite the back flue sheet, the top connection of which entered the wrapper sheet on the top center line, 15 in. back from the throttle dome, while the bottom connection entered the wrapper sheet on the side. The lowest reading of this glass was 1 inch above the highest part of the crown sheet. This glass will hereafter be known as the "experimental water glass."

With this arrangement, observations were made during five additional trips, when the same conditions were found to exist that had been noted in the previous tests, with respect to the original gage cocks, namely, full water showed at the top gage cock, regardless of the level indicated by the water glasses, while the experimental gage cocks indicated a level approaching that indicated by the water glasses while operating with open throttle or safety valves blowing.

While operating with throttle wide open and water glass three-fourths full, the bottom connections to both water glasses were frequently closed and drain valves opened, when dry steam would steadily flow through the experimental water glass and solid water would flow through the original water glass, which glass also showed the water in severe agitation while the locomotive was in operation. These experiments demonstrated that the level of water indicated by the gage cocks and water glasses varied with their point of connection with the boiler, and indicated that a higher level of water prevailed at the back head than existed further ahead.

It is believed that the transverse "T" iron, which was applied to the back heads of these boilers, hindered the movement of water up the back head near the center, and consequently decreased the variation between the level of water indicated by the experimental gage cocks and that registered by the water glass.

As a result of these experiments, which were brought about

*This account tests recently conducted by the Bureau of Locomotive Inspection was prepared by A. G. Pack, chief inspector, through whose courtesy the article is published.

by the large number of crown sheets being damaged and fusible plugs being melted, the gage cocks and water glasses were moved toward the vertical center line of the boiler, which seems to have relieved the situation to a considerable extent.

Second Series of Tests

It having been concluded that the false registration of the gage cocks, when screwed directly in the boiler back head, and the agitation of the water in the water glass when top connection is made near the knuckle, were due to the rapid circulation of the water upward, carrying it a considerable distance above the level further ahead, a number of locomotives of the following description were equipped with water columns, as shown by Fig. 1:

These locomotives were of the Santa Fe or 2-10-2 type, equipped with Schmidt superheaters, Street stokers, used bituminous coal for fuel, carried 180 pounds steam pressure, with firebox 132 inches long and 96 inches wide, with brick arch supported by four arch tubes and back head sloping 15° from vertical.

The water column applied on these boilers, as illustrated by Fig. 1, was 1¾ in. inside diameter and 16 in. long, applied in a vertical position on the back head, 18 in. to the right of the vertical center line. The top connection was made by means of an angle valve with extension handle, extending through the top of cab, and copper pipe 1-1/16 in. inside diameter, entering the wrapper sheet 12½ in. in front of the back head knuckle and 14½ in. to the right of the top center line. The bottom connection was made of copper pipe 1-1/16 in. inside diameter, and entered the back head, through a three-way cock, 16 in. to the right of the vertical center line and 28 in. below the back end of the crown sheet. Three standard gage cocks with ⅜ inch openings were attached to the right side of this column, three inches apart. One water glass was also attached, with standard fittings, having ¼ inch opening. The lowest reading of both water glass and gage cocks was 4½ in. above the highest part of the crown sheet.

By this arrangement, it was believed that when entering the boiler far enough ahead of the back knuckle to obtain dry steam at all times through the top connection to the column, and by taking water from well below the crown sheet and below the agitated portion of water, a more correct reading could be obtained than when the gage cocks were screwed directly to the boiler head. During the approximate six-month period that these locomotives were operated with this arrangement, however, very considerable trouble was encountered, due to the extremely erratic and unreliable water indications.

When the matter was brought to the attention of the Bureau of Locomotive Inspection it was determined that something should be done to learn just what caused the trouble. Therefore, one round trip was made, covering 240 miles, where observations were taken under actual operating conditions, with the following general conditions noted:

At first start there was 3½ inches of water in the glass, reverse lever in full forward motion, with engine working up to the slipping point and working considerable water through the cylinders for about two miles. When locomotive was started the water in the glass receded very rapidly until it disappeared. The left injector was started and by opening any of the gage cocks, which had openings ⅜ inch in diameter, after the water had disappeared, dry steam was emitted for a few seconds, when the water in glass and column would rise to the cock that was opened and would be maintained unsteadily at the same level until the gage cock was closed, when the water in the glass would instantly recede slightly below this cock, which would be two to five inches higher than the level indicated before the gage cock was opened. From this point the water would gradually recede, taking four or five minutes to drop to the low point, and, when reached, the water would work normally in the glass, but would gradually recede to different levels and sometimes out of sight, depending upon the temperature of the water in the lower connection to the column.

This test was made many times during the trip and in all cases practically the same results were obtained. When the drain cock to the water glass was opened, the water in the glass and column would be raised as a result, and, when closed, the same receding conditions prevailed as when the experiments were made with the gage cocks, but would again settle to an indefinite point, sometimes out of sight, depending upon the temperature of the lower column connection. The gage cock was frequently opened slightly, so as to create a slight circulation through the column, which kept the temperature in the column and connection approximately that in the boiler, during which time the column glass and gage cocks appeared to register correctly.

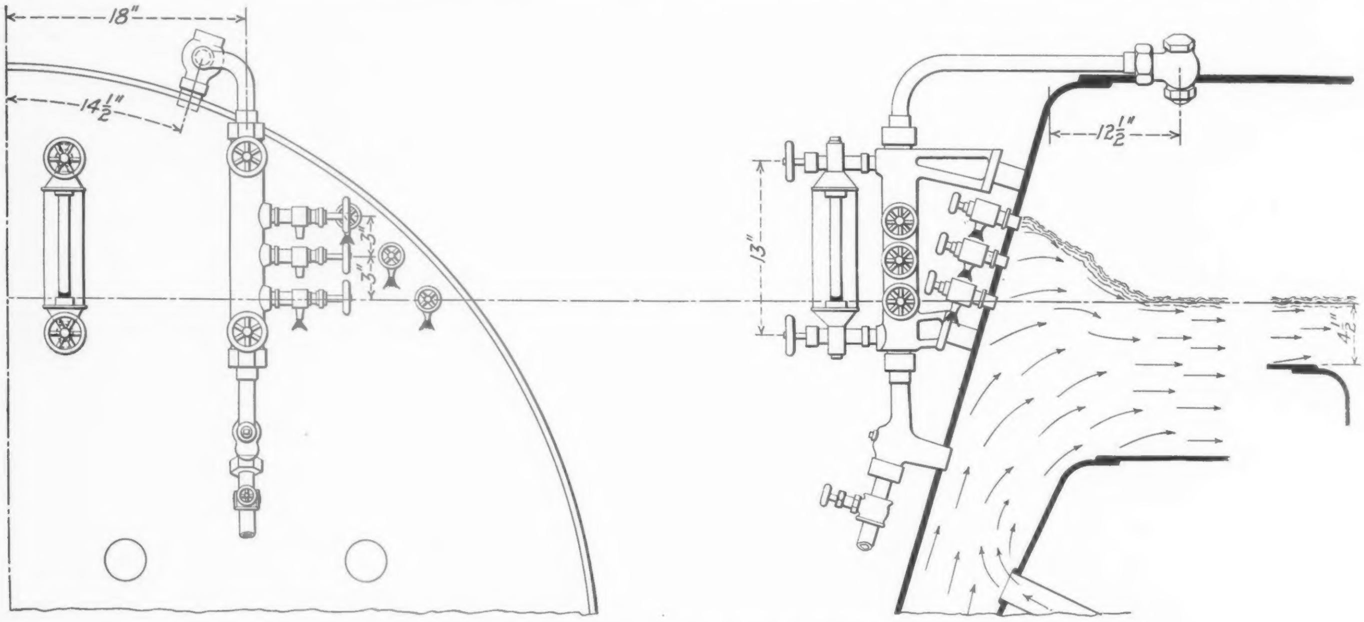


Fig. 1—Water Indicating Devices Used in Preliminary Tests

Numerous other observations were made, which gave results similar to those outlined above. During these tests the temperature of the atmosphere was below zero, which caused the water in the column and in the long pipe by which the bottom connection was made to cool rapidly, which in turn caused the level of water in the column to lower. In order to demonstrate that this reduction in temperature was the cause of the receding action in the column, ice water was poured on the bottom of the column. This caused the water in the column to lower very quickly while being cooled, and it would rise as soon as circulation was again established in the column.

It was demonstrated by experiments that this lowering of water in the column was due to the volume of dead water contained in the long pipe through which the bottom connection to the column was made. This was evidently due to the density and weight of the water at different temperatures, the temperature being much lower than that of the water in the boiler, due to the pipe and column being exposed to the cold atmosphere without circulation.

After noting these results and for the purpose of comparison, another water glass and set of three gage cocks were applied in the usual manner, as illustrated by Fig. I, the water glass connections entered the back head at the left of column and the gage cocks entered near the knuckle. The comparative readings of all gage cocks and water glasses corresponded. For reference purposes the gage cocks and water glass applied to the column will be referred to as No. 1, while those applied in the usual way will be referred to as No. 2.

With the indicating devices arranged as outlined, observations were made during three successive trips, or 720 miles, when the following general results were noted:

Previous to starting, all devices indicated a corresponding level, but, when the throttle was opened or safety valves lifted, the water in No. 1 glass would recede approximately 2 in., while that in No. 2 glass would rise. No. 2 glass indicated a level of water from 1 in. to 3 in. higher than that indicated by No. 1 glass. In some cases, however, the water was out of sight at the bottom of No. 1 glass, while No. 2 glass indicated a level of from 3 in. to 5 in.

After noting these results, the following change was made: The bottom connection to the water column was raised 28 in. and moved to the right 2½ in. The new connection was made *midway between the two right arch tubes* and approximately 10 inches above them, about in line with the back end of the crown sheet. The object of this change was to move the bottom connection up as close to the lower end of the column as possible, and to reduce the volume of dead water in this connection in order to eliminate the lowering effect referred to. After this change had been made, the following general results were obtained: When starting, the level in both water glasses rose slightly and both glasses worked normally; and when the throttle was closed the level would recede slightly, the readings of both glasses corresponding under all conditions of service.

A comparison of the No. 1 gage cocks with the No. 2 water glass showed that they registered the same level when the gage cocks were opened moderately, or a sufficient amount to obtain a correct reading, but by opening the No. 1 gage cocks an excessive amount, or wide open, the water in the column and attached glass would rise from the bottom to the level of the cock opened. When the gage cock was closed, the water would instantly recede to its original working level and correspond with that shown in No. 2 glass. The receding action, as noted in the previous tests and before the bottom connection was raised, was entirely absent and the water registered a corresponding level in both No. 1 and No. 2 glasses under all conditions of service.

Tests of the No. 2 gage cocks, located as they were near the knuckle of the back head, proved that they were wholly unreliable for the purpose of registering the correct level of the water in the boiler while the locomotive was working, as they showed full water at all times, throughout the entire test, regardless of the level indicated by the water glasses and No. 1 gage cocks while steam was being rapidly discharged from the boiler, due, without question, to the rise of water up the back head. While standing, and with no steam escaping, the readings of both water glasses and all gage cocks registered alike.

Further observations and tests were made while on heavy grades, but no unusual or improper conditions could be noted except that No. 2 gage cocks registered full at all times, as previously stated, and the water in the column glass could be raised to the height of the gage cock opened, when opened excessively.

The opening in the bottom connection to the water column was then reduced to ¾-in. and observations continued. It was thought that by restricting the inlet at the bottom of the column it would prevent the water from rising in the column and attached glass when the gage cocks were opened excessively. The opening in the gage cocks was also reduced from ⅜ in. to ¼ in. inside diameter, so as to disturb the equilibrium of the water in the column as little as possible.

On this trip particular attention was given to the action of the water, as registered by the water glasses and No. 1 gage cocks by comparison, and it was particularly noted that the level of the water corresponded at all times under the varying conditions of service, while the standard gage cocks registered full water at all times with a high evaporation taking place.

As previously stated, in the original arrangement the top connection to the column was fitted with an inaccessible valve, the handle of which extended through the roof of the cab, thus making it difficult to tell whether or not the valve was open and the column in communication with the boiler at the top. In order to eliminate the possibility of these valves being left closed through carelessness, as is often done with water glass cocks, they were removed. The necessity for removing these valves was demonstrated by the serious damage to a crown sheet, by overheating, while the water showed in the water glass and the column gage cocks, due to one of these valves having been left closed on one occasion, while the locomotive was being prepared for service.

Third Series of Tests

The locomotives on which these tests were made were U. S. Railroad Administration standardized heavily Mallet 2-8-8-2 B type, with boiler and firebox of the following dimensions:

Boiler, type	Straight top
Boiler, pressure	240 lb.
Firebox, length	170⅛ in.
Firebox, length of grate	143⅝ in.
Firebox width	96¼ in.
Combustion chamber, length	37 in.
Heating surface, tubes and flues	5,685 sq. ft.
Heating surface, firebox	386 sq. ft.
Heating surface, arch tubes	49 sq. ft.
Heating surface (total)	6,120 sq. ft.
Grate area	96 sq. ft.

The crown sheet was 15 ft. 7 in. in length, with firebox equipped with Gaines furnace, and brick arch extending to within 68 in. of the door sheet and within 22½ in. of the crown sheet, supported by five 3½-in. arch tubes, using bituminous coal for fuel and fired with Duplex stoker. The boiler was equipped with one water column to which three gage cocks and one water glass were attached. Two gage cocks were applied directly in the back head and two water glasses applied in the usual manner, one on each side of the vertical center line of the back head as illustrated by Fig. 2.

The lowest reading of the gage cocks attached to the water column, and all water glasses, was 8 in. above

the highest point of the crown sheet and 13⅛ in. below the top of boiler back head. The limited dry steam space at the back end of this boiler had a marked effect on the readings of these devices when connected in the back boiler head.

Numerous observations were made on a number of locomotives of the same type, for the purpose of comparing the action of the water in the gage cocks and water glasses as originally applied and after certain changes were made. For the sake of brevity, however, the tests made on only one of these locomotives will be described, inasmuch as the results obtained were the same in all cases.

For the purpose of comparison, each of the connections was fitted with a valve, and extension handle, so they could be easily opened and closed, allowing changes from one to the other at will. The top connection to the right water glass was changed from its original location, which corresponded to that shown for the left one, to the location shown at B1 on the highest part of back head knuckle.

It will be readily understood that when water, from any cause, reaches the top connection, it destroys the proper registrations of these devices, and the idea in mind, when arranging the top connections in the manner illustrated, was to determine whether or not the reading of the water glasses and water column would be altered when changing from one connection to the other, which were in line with the upward flow of water between the door sheet and the back head, the object being to obtain dry steam to balance the volume of water in the water glasses and water column. The result of changing from one connection to the other was indeed surprising.

A1—*Water column connection where it entered boiler on back head knuckle ½ in. higher than top gage cock and 6⅝ in. below highest part of back head as originally applied.*

A2—*Water column connection where it entered boiler at highest point of back head knuckle.*

A3—*Water column connection where it entered boiler on top center line in front of back head.*

B.—*Right water glass.*

B1—*Right water glass connection where it entered boiler in back head knuckle.*

B2—*Right water glass connection where it entered boiler in front of back head.*

C.—*Left water glass.*

C1—*Left water glass connection where it entered back head knuckle 4½ in. below highest point of back head, measured vertically and 2⅛ in. above top water glass reading, as originally applied.*

C2—*Left water glass connection where it entered boiler in front of back head.*

With the locomotive working heavy throttle, column A and glass Ax, connected at A1, the original connection, would be completely filled, while glass B, connected at B1, indicated 1 inch of water. By changing the connection A1 to A2, the water would instantly recede to a level in A and Ax corresponding with that indicated by glass B, or 1 inch, when A, Ax and B would continue to correspond while connected at A2 and B1, until the reading approached 4½ to 5 in., at which point the water would become erratic and soon fill column A and glasses Ax and B if the injector was slightly over-supplying the boiler, or would recede and correspond if the water was slightly lowering in the

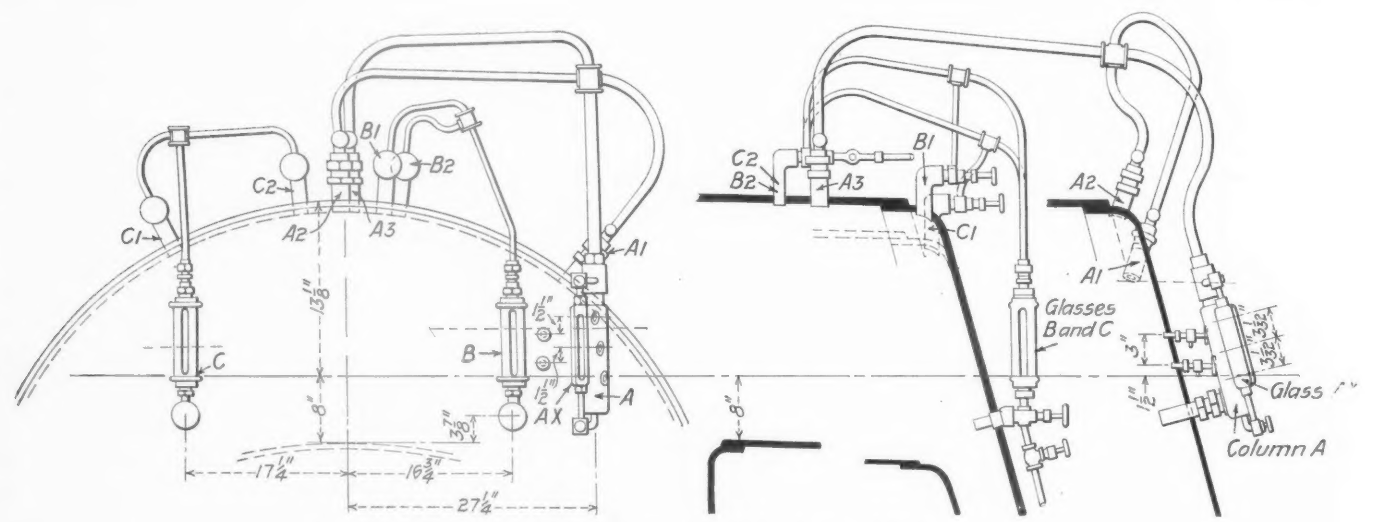


Fig. 2—Water Indicating Devices Used in Third Series of Tests

With the locomotive equipped with water glasses and gage cocks, as shown by Fig. 2, it was used in pusher service, on an ascending grade of 61 feet per mile, during five successive trips, occupying a period of time aggregating four hours and twenty-five minutes.

While the locomotive was standing, with no steam escaping, the registration of all devices showed a corresponding level of water. A total of 121 readings were taken and recorded while on straight track and while the locomotive was working with heavy throttle with about the same firebox temperature and steam pressure.

For reference purposes, the water glasses and water column, with their connections, are referred to by letters and figures as follows:

A.—*Water column to which three standard gage cocks were applied.*

Ax—*Water glass applied to water column.*

boiler. This indicated that the water was moving up the back head, with fountain effect, to a point reaching the connections A2 and B1 where they entered the top knuckle of the back head, 8⅛ in. higher than they registered when connected at A3 and B2 on the wrapper sheet, and was illustrated by changing the connection to column A and glass B from A2 to A3, B1 to B2, when the water would instantly recede to its former reading, and the readings would then continue to correspond as long as the connections remained at A3 and B2, without regard to condition of service or height of water indicated.

These readings could be varied as often as desired, by shifting connections to the boiler by use of the valves; that is, when the column connection was changed from A3 to A2, the water would immediately go from 5 in. to out of sight in glass Ax, and top gage cock would show full water; or, when changed from A2 to A3 the water would

recede from out of sight to a level of 5 in. and correspond to the reading shown by glass B connected at B2. With glass B connected at B1, the reading would correspond with column A and glass Ax when connected at A3, until the level approached 5 in., when the water in glass B would become erratic and soon fill the glass, while column A and glass Ax, connected at A3, retained their level of 5 in.

These experiments illustrated that column A and glass Ax were incorrect when connected at A1, the original connection, with 1 inch or more of water; and, when connected at A2, were incorrect when the level indicated exceeded 4½ in. to 5 in.; and correct at all times when connected at A3; and that glass B was correct when connected at B1, until the reading indicated 4½ in. to 5 in., and incorrect when more water was shown, until connection was changed to B2.

With glass B registering 5 in. of water, the connection was changed from B2 to B1, when the glass would immediately fill; and with the bottom water glass cock closed and drain valve open, solid water flowed steadily through the drain pipe, which showed conclusively that the flow of water up the back head, with fountain effect, reached the connection B1 where it entered the back head knuckle 8⅛ in. higher than the correct level of water in the boiler or that registered by glass B when connected at B2, and by A and Ax when connected at A3.

With glass C in communication with the boiler at C1, its original connection, it registered a level corresponding to that indicated by column A, glass Ax when connected at A3, and with glass B when connected at B2, until the water registered 2½ in. to 3 in., at which time the water in glass C would become erratic, rising and lowering and rapidly filling, providing the injector was more than supplying the boiler, notwithstanding column A and glasses Ax and B, connected at A3 and B2, worked normally and indicated 2½ in. to 3 in. of water.

When glass C communication was changed from C1 to C2, the water would instantly recede from out of sight at top to a level of 2½ in. to 3 in. and give a corresponding reading with column A and glasses Ax and B, which was true at all times when all connections were made ahead of back knuckle, regardless of the condition of service or the level of water in the boiler.

The reading of glass C, when it indicated in. or more of water, could be changed as frequently as it was desired, by changing the communications from C1 to C2 or vice versa.

It was noted on one occasion, with column A connected at A1, glass B connected at B2 and glass C connected at C1, the locomotive moved to a left-hand curve, at which time water glass B registered 2 in. of water while column A and glasses Ax and C were completely filled.

Sixteen readings were taken on the fourth trip, with column A connected at A1, the original connection, glass B at B2 and glass C at C1, original connection, during which time glass B indicated a level of from 1¼ in. to 4¾ in., while glasses Ax and C and all gage cocks in both column and back head showed full of water. In fact the gage cocks applied directly in the back head showed full of water at all times during these tests, while the locomotive was being operated or when the safety valves were open.

By referring to Fig. 2, it will be noted that connections to water glasses are made to the boiler through ell connections. In changing the street ells from their original location on the back head to the location shown at B2 and C2, the C2 connection was tapped so as to drain thoroughly, while B2 was leaned sufficiently to cause a trap to be formed. This trap caused the water in B glass to rise 2 in. to 3 in. higher than that registered by the left glass; and when this trap was removed, the water indication in all three glasses corresponded. This condition has been found in a number of the locomotives under investigation, when, as soon as the traps were removed, the discrepancies were obviated.

(To be continued)

FUEL STATIONS

At the 1915 convention several devices were reported for measuring the coal as delivered to locomotives, but at that time none of the suggested equipments had been extensively used. Since that date, however, there has been a considerable number of at least two of the suggested types of equipments installed and maintained regularly in service.

One of the earliest installations is that of the Nashville, Chattanooga & St. Louis at Cowan, Tennessee. These machines have been operating since 1916 with an average issue of 200 tons of coal per day and have handled up to a recent date approximately 192,000 tons. This railroad also has six additional equipments of the same type at three other points. At one of these stations the record for the past twenty months,

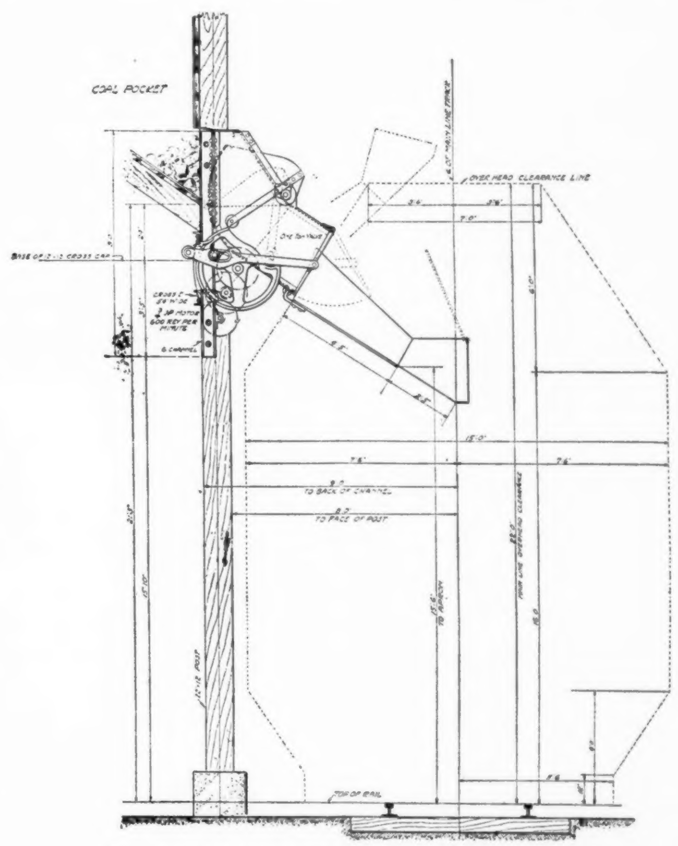


Fig. 1—Coal Measuring Device, N. C. & St. L.

with no break-down, indicates 150,000 tons of coal issued, one device recording 88,234 tons.

Fig. 1 outlines the general arrangement of this type of measuring device and illustrates its application to an existing chute. This machine is operated with a two-horsepower electric motor in one continuous rotary movement in one direction. It is so designed that as the delivery gate is opened, the undercut gate arm rolls on the surface of the large cam, in that way locking it. When the undercut gate is down, ready to receive the issue of coal from the bin, the delivery gate is also locked, and these movements alternate so that it is impossible to have both gates open at the same time and thus release a bin full of coal. The ordinary operation is five cycles per minute. As first constructed, the cut gears used

*From a report presented at the 1920 convention of the International Railway Fuel Association.

were made of cast iron. These broke in several instances, so that all steel gears are now used with the equipment.

There is one feature in connection with the use of such power driven machinery as this which should be mentioned, and that is, that it is a practical necessity to have the coal issued by the assigned operator at the coaling station. Such a mechanism should not be handled promiscuously by many different men, most of whom would know nothing beforehand of its construction or method of operation. This equipment, the same as other parts of mechanically operated coal chutes, requires regular and systematic attention and maintenance.

As illustrating the second type of measuring device, the Chicago, Milwaukee & St. Paul in 1918 installed the equipment shown in Fig. 2 on a 75-ton coal chute at Jackson, Minn. With this equipment the operator, after lowering the chute into position, discharges the coal from the measure by pulling on the operating rope. The locked-in position of the unbalanced measure is thus released and the entrained coal is discharged, the inlet gate being automatically closed. When the measured coal is all discharged, a second pull on the operating rope tilts the measure back

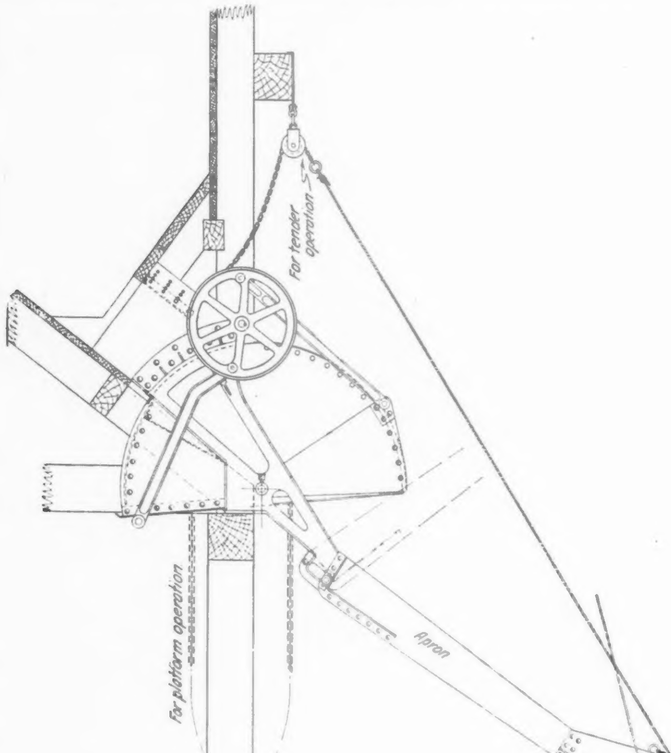


Fig. 2—Coal Measuring Device, Jackson, Minn., C. M. & St. P.

again to the filling position, closes the outlet gate and opens the inlet gate. As the measure is again filled the operations are repeated. The reported time for taking five measures or five tons of coal is three minutes, that is, from the instant that the engine stopped in front of the chute until it started away. There are 14 engines taking coal at this point, averaging 5.8 tons per engine. A recent report on this particular installation advises that, "There is no question in our minds, however, but that this device gives much closer approximation to correct weights than the old method of estimating weights. The device appears to be satisfactory to all concerned and it costs much less to install than scales."

Discussions and reports presented at the convention from year to year have called attention to the necessity of delivering the coal into the storage bin in such a manner that the fine and coarse coal will not segregate, with the resulting effect that one locomotive tender will receive all coarse lump coal and the next one get only the fine and in some cases almost powdered coal. The coal should fall on the pile in the bin at a point directly over the discharge opening. The natural separation of the coarse coal toward the lower edge of the pile will not then materially affect a fairly uniform mixture of the coarse and fine coal at the point of discharge. Fig. 3 illustrates the arrangement which caused the trouble. The bucket conveyor delivered the coal over the idler at the

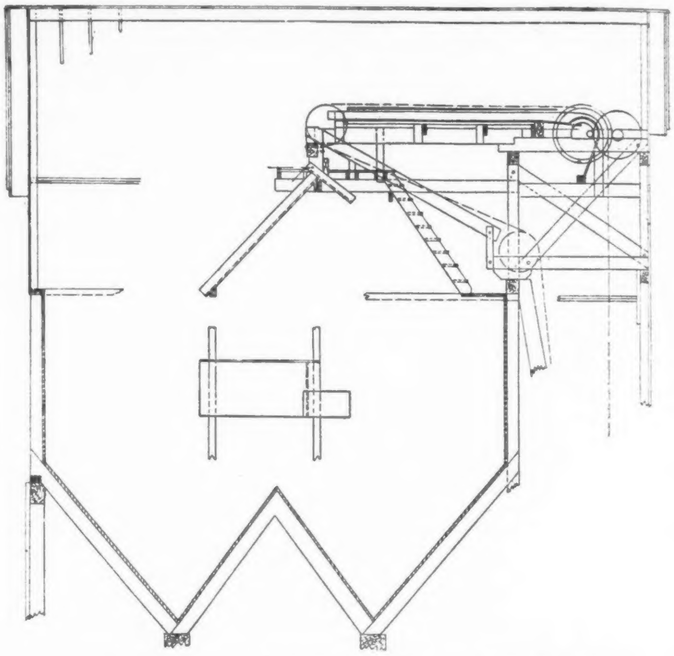


Fig. 3—Improper Discharge of Coal to Storage Bins

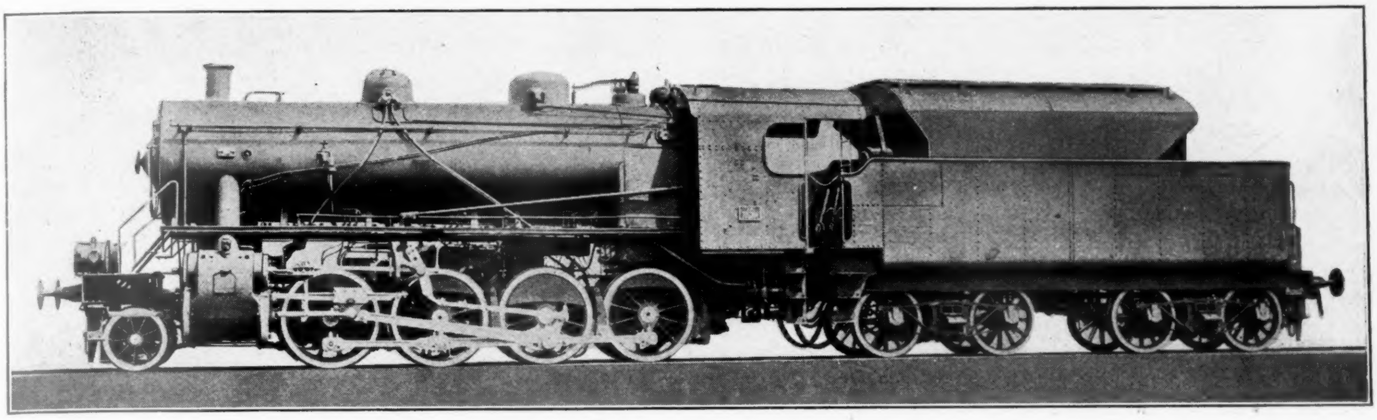
center of the bin. The coal then dropped to the upper ends of the two inclines shown, but in passing over the edge of the conveyor, practically all the lumps threw over onto the long incline and only fine coal dropped onto the short incline. Further, the momentum of the coal on the long incline was such that the coarse coal was all delivered on the pile against the left hand wall of the bin and as the bin was filled full only fine coal worked over the center ridge to the right hand discharge opening. By eliminating the inclines and providing a discharge opening in the conveyor directly over the center of the right half of the bin, coal is being delivered to each of the two tracks well and uniformly mixed.

Another railway reports satisfactory improvement in the mixing of the coarse and fine coal by the use of a baffle at the lower end of the distributing chutes. The purpose is to deflect the lumps downward so that they will fall vertically with the slack instead of falling over to one side of the pocket and there forming a mass of lump coal. However, this does not, as arranged, apparently entirely eliminate the separation trouble.

[The report included a number of illustrations of typical fuel oil stations, which were presented without critical comment.—EDITOR.]

The report was signed by W. E. Dunham (Chairman), C. & N. W.; E. E. Barrett, J. C. Flanagan, J. W. Hardy, W. T. Krausch, R. A. Ogle, J. L. Ripley, C. F. Luddington, C. M. & St. P., and J. E. Nellegar.

OIL BURNING ENGINE EXPLODES.—A yard engine used for shifting cars in the Mt. Clare yards of the Baltimore & Ohio recently exploded, injuring seven men. While the cause of the accident has not been determined, it is believed that one of the feeds became clogged, allowing the oil to back up and generating considerable gas.



Italian Locomotive Equipped for Burning Pulverized Coal

Pulverized Coal Burning Equipment for Europe

Description of Locomotives Recently Designed to Utilize Low Grade Coals in Italy and Holland

FROM an economic standpoint the war has affected nothing more radically than the relation of supply and demand for fuel. This basic commodity, which has always been more costly abroad than in the United States, has now become fabulously expensive in those countries in Europe that are forced to import coal. Italy and Holland are in this class, although there is a native supply of very inferior coal in both countries. The desirability of utilizing this native fuel is accentuated by the fact that each of the European countries, as a result of the lessons taught by the great conflict, is more anxious than ever to become independent of outside sources for its basic commodities. This applies particularly to coal, and for matters of diplomatic policy alone, both Italy and Holland find ample incentive for undertaking expenditures for special equipment that would enable them to utilize the coal available within their borders. In this connection it was thought that pulverizing as a means for utilizing native low grade coals was worthy of a trial and the results will be watched with unusual interest in the United States, where enormous deposits of lignite coal are lying untouched. Barring consideration of any higher efficiencies that may obtain with the consumption of fuel in a pulverized form, the fact that it may render available relatively inexpensive fuels that can now be mined directly tributary to many railroads warrants the most serious consideration in a country where there will probably never be any necessity to import basic commodities.

It is highly complimentary to American manufacturing enterprise that after making a thorough investigation of the field, the engineers from both the Italian and the Netherland State Railways selected coal pulverizing and pulverized coal burning equipment developed and manufactured by the Fuller Engineering Company of Allentown, Pa.

Lignite Coal Available in Italy

The Italian State Railways have had to depend entirely on imported coal for locomotive fuel, which is now costing them about $34 a ton in United States currency. The native coal in Italy is a very low grade fuel and unsuitable for hand-fired locomotives. It is largely in the form of lignite and this has led the State Railways to equip two of their new heavy Consolidation type locomotives for burning pulverized coal, as it is thought that this grade coal can be burned in a pulverized form.

There are a great number of lignite coal mines in Italy, the largest of which has an annual output of nearly 1,000,000 tons. These mines are located in several different parts of the country and the coal from various localities exhibits a wide range in composition. The following analyses may be taken as representative:

Moisture (determined separately)	25.7	29.2	31.4	6.4	28.6
Volatile	31.1	47.8	46.9	2.4	32.3
Fixed carbon	20.8	36.3	40.8	66.1	58.5
Ash	48.1	15.9	12.4	31.5	9.2
B. t u. (dry basis)	4,918	8,977	9,072	9,337	11,606

The last of an order of 150 Consolidation type locomotives for the Italian State Railways was being completed in the shops of the American Locomotive Company at Schenectady, N. Y., when it was decided to apply pulverized coal burning equipment to two of these locomotives. The order was placed with the Fuller Engineering Company and was completed in less than 60 days from the date of order. The locomotives were tested out with pulverized coal (about 10 tons being consumed on the two locomotives), knocked-down and shipped to Italy.

Description of Locomotives

The locomotives have the following specifications:

Cylinders	21¼ in. by 27½ in.
Steam pressure	170.6 lb. per sq. in.
Drivers, diameter	54 in.
Weight on drivers	131,500 lb.
Total weight	148,000 lb.
Grate area	34½ sq. ft.
Maximum tractive effort	33,400 lb.
Heating surface:	
Tubes	1,331 sq. ft.
Flues	485 sq. ft.
Firebox	117 sq. ft.
Superheater	407 sq. ft.
Water capacity	5,900 gal.
Fuel capacity	10 metric tons
Wheel base, engine and tender	55 ft. 3-1/16 in.

Practically the only change necessary in the tender was to substitute a U-shaped tank, move the tank bodily on the tender back toward the rear 7 inches in order to better distribute the weight on the front and rear trucks. Due to the compactness of the equipment it was possible to install it without in any way altering the water legs from the standard design of the other tenders, the only change in this respect being that the hand brake handle had to be raised somewhat to allow for clearance. As only one coal plant is to be provided in the initial installation it was of course necessary to provide for a much larger fuel capacity than on the hand fired locomotives, which is the reason for applying a tank holding 10 metric tons. A standard American type of brick arch supported on tubes is placed in this locomotive firebox and the sides of the combustion chamber beneath the firebox proper are bricked

up in a standard manner with air vents controlled by dampers, these all being controlled from the cab on the fireman's side.

Pulverized Coal Equipment

The coal is blown in suspension from the tender to the locomotive through 2 ft. 5 in. dia. flexible hose, and the coal feeder is controlled from the fireman's position in the cab by means of a flexible shaft, the ratio between the minimum and maximum coal feed of 346 per cent being obtained and this ratio is again doubled by throwing in or out either one of the two pairs of feed screws by means of the clutches, which project over the apron within easy reach. Four 4-in. dia. steel feed screws operating in pairs draw the coal from the bottom of the tank to the front of the feeder, where it is met by the air from a steam turbine driven fan and blown into the firebox. The feed screws are driven by a two-cylinder, double acting reciprocating engine, enabling the widest variation to be obtained with the minimum steam consumption at all times. A feature of this equipment is that the screws can be started up and operated on 25 pounds of steam pressure. This is a great advantage when it is considered that very often the pressure in roundhouse firing up lines drops to 30 pounds. Due to the screws being operated in pairs, it is impossible for the coal to arch over at any time and a steady constant feed is obtained at all times, no matter how heavy the coal or how long it has been in the tank.

At the same time the order was placed for the locomotives a pulverizing plant was also ordered from the Fuller Company to consist of two standard 42-in. screen type Fuller-Lehigh pulverizing mills having a capacity of approximately 4 tons per hour each, a standard drier, fired by pulverized coal and having an approximate capacity of 10 tons of dried coal per hour. The coal plant throughout is of the standard type with track hopper for receiving the coal from the cars, single roll crusher for crushing it down to the proper size for the pulverizing machines, magnetic separator for removing all tramp iron, etc., and all necessary conveyors, elevators, as well as 40-ton pulverized coal storage bin divided in half, which is placed over the track. Two separate butterfly valves with filling spouts are provided for coaling the locomotives. The plant is driven throughout with electric motors and is equipped with dust collectors, separators, etc., in order to make a clean, dustless, modern plant.

Fuel Situation in Holland

There has been an enormous increase in the cost of fuel imported by Holland for firing locomotives and in order to utilize the cheaper grades and culm piles which have accumulated during many years, the Netherland State Railways have decided to equip two express type passenger locomotives for burning pulverized coal as an initial experimental installation. After a thorough investigation of the subject in their own country and abroad an order was placed with the Fuller Engineering Company in January, 1920, for two complete locomotive equipments as well as a coal pulverizing plant for furnishing these locomotives with pulverized coal.

The coal which is now being hand fired has the following approximate analysis:

Moisture	20 per cent	Ash	7 per cent
Volatile	12 per cent	Sulphur	1 per cent
Fixed carbon	80 per cent		

B. t. u. value, 14,000.

The coal which it is desired to utilize in pulverized form has the following analysis:

Moisture	4 to 14 per cent	Ash	9 to 15 per cent
Volatile	9 to 24 per cent	Sulphur	1 per cent
Fixed carbon	52 to 74 per cent		

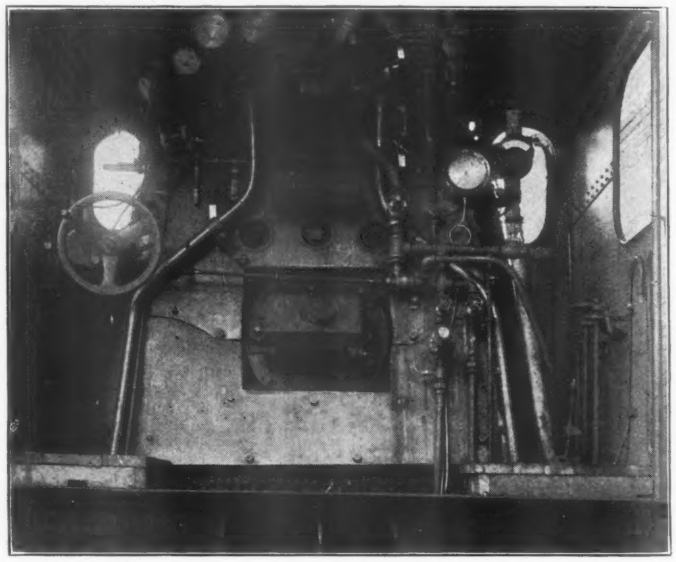
B. t. u. value of this coal, 11,000 to 13,000.

Locomotives which it has been decided to equip are of the ten-wheel type with four simple high pressure cylinders in the same plane, two outside of the frame and two inside. The specifications of the locomotive follow: Cylinders, 15¾-in. by 26 in.; steam pressure, 170 lb. per sq. in.; drivers, 73 in. dia.; weight on drivers, 96,000 lb.; total weight, 140,000 lb.; firebox, 110 7/16 in. by 39⅞ in.

A unique feature of this locomotive, and one which will make it particularly adaptable to pulverized coal, is that on account of having four high pressure cylinders there will be eight exhausts for each revolution of the drivers, which will of course produce a much more even draft through the tubes and firebox.

Description of Equipment

Equipments which will be installed are duplicates, with a few improvements and alterations, of the ones furnished to the Italian State Railways and are also very similar to the one which has been in use on a Lehigh Valley locomotive for the past year, burning mixtures of anthracite silt and bituminous coal with success. The coal plant will contain two 33-in screen type pulverizers, an indirect pulverized coal fired drier with all necessary motors, elevators, dust collectors, etc., to make a complete and modern plant in every detail.



Interior Cab, Italian State Railway Locomotive

The coal will be received direct into a track hopper from the car and will be crushed down to standard size for the pulverizing mills and delivered to a 20 ton storage tank for coaling the locomotives over a track adjacent to the pulverizing building. The operation will be continuous and entirely mechanical from the time the coal leaves the cars until it is placed in the storage tank over the track. The tank in which the pulverized coal is carried will hold 8 tons of pulverized coal, enabling a round trip to be made with only one fueling. No changes in the outside arrangement of the tender whatever are made, thus enabling the water to be taken as at the present time, at any place along either side of the tender, in the troughs provided, as this is standard practice on the Netherland Railroads. The locomotive will have a brick arch supported on lugs, as it is now standard practice in Holland.

Due to the difference in cost of the coals which they are now burning and which they intend to burn, it is calculated that the whole investment can be paid for in one year, due to the savings resulting therefrom, and it is the intention of the company working the Netherland State Railways to extend the application of pulverized coal burning equipment to other locomotives of suitable size and type as soon as the two which are now ordered have been in operation long enough to determine how much these savings amount to.

CAR DEPARTMENT

BETTER FOUNDATION BRAKE GEAR AND AUTOMATIC ADJUSTMENT NEEDED

BY W. H. SAUVAGE

The use of automatic slack adjusters on electric equipment is becoming general throughout the country. On steam railroads spasmodic attempts to use these devices have been made for several decades. Perfect regulation when made by hand is ideal, but human agency is not dependable. In order to obtain perfect adjustment of the brakes the first requisite is to have a satisfactory foundation brake gear. In recent years more attention has been paid to getting a stronger and less flexible gear than in the past; however, the roads have not departed from first principles in simplifying the foundation brake gear to any appreciable extent. It is true that the roads are gradually retiring outside hung brakes and generally adopting the more reliable inside hung brake, with the brake beam hangers so attached as to prevent their deflection on the wheels, whether cars are empty or loaded, so that more uniform piston travel and brake chain take-up becomes possible.

While this improvement has been in the right direction it should never stop there. Pullman and electric cars have all truck levers standing vertically along the center line of the truck, thus producing as nearly as possible 100 per cent efficiency. This, however, is not the case with freight car equipment or locomotive tender trucks; without any exceptions all car trucks still use truck levers set at an angle of 40 deg., which necessitates a right and left brake beam for every truck. A few years ago a more simple, compact, and reliable brake gear with all truck levers vertical was introduced. This arrangement does not require right and left brake beams, making every beam interchangeable, or by using a reversible strut it allows the use of levers set at a 40-deg. angle when so desired.

This simplified foundation brake gear does away with four clevises, two lever fulcrums and two extra floating levers which are required at the present time to get the reverse pull on the truck levers on opposite ends of the car. The cylinder levers remain of equal dimensions as before, the pull rods are attached thereto in the center line of the car to the truck levers direct; in this manner they do not interfere with hopper bottom arrangements. Providing this direct connection, thus eliminating the extra floating levers and guides, reduces friction to a minimum, making both the power and hand brakes more efficient than under the old arrangement. Brakes release more promptly, preventing unnecessary brake shoe drag, which reduces the tractive effort of a locomotive often as much as 20 per cent.

When brakes with a modern gear require adjustment, conditions will immediately be improved, whether made manually or automatically. Manually adjusted brakes we are all quite familiar with, but we are not yet fully convinced of the advantages of automatic adjustment. Many automatic devices for adjusting brakes have been brought out from time to time during the last 25 years and some have shown a great deal of merit. Simplicity is the first requirement for an automatic device, next reliability, while durability is essential, especially for freight car equipment.

Let us analyze what it means to have ideal adjustment of brakes on freight cars. Dragging brakes consume a great deal of energy, limiting the hauling power of the locomotive, consuming more or less unnecessary fuel, delaying movements of trains from point to point and causing improper air brake performance. This is primarily due to brakes being adjusted too tight against the wheels. Frequently cars have long piston travel and yet the brakes are found dragging. This is not always entirely due to improper foundation brake gear, but more often arises from the methods employed by the man who adjusts the brakes. In any freight yard when the inspector finds a car with long piston travel he takes advantage of shortening this travel under the end of a car which seems to require the least labor to take up the slack. As a rule he does not go to the trouble to take up or let out the false piston travel on the truck that needs it most, but gets under the easiest end and pulls up the dead lever as far as it will go, and usually manages to get the travel within a few inches of what he wanted it to be. If it is a little long or a little short doesn't matter, to obtain the exact piston travel he desires would require considerable time, so he lets it alone. What the inspector should have done was to balance up the levers on each truck and not allow the shoes on one brake beam to stand away several inches off the wheel on one truck, with the shoes tight against the wheels on the other truck. To do this properly it would probably be necessary to take up slack on the bottom rod connection, but that means more work, and he follows along the lines of least resistance, which is human nature. To get absolutely perfect adjustment is a slow process. The time required to properly adjust brakes on a 100-car train to some predetermined piston travel is often serious and leads to expensive delays aside from the labor involved.

What does it mean to have a train of cars running over

the road or in classification or hump yards with imperfectly adjusted brakes? In the first place the brake gear is the fundamental foundation upon which rests all the good or evil results to be obtained by the use of the air brake. The air brake mechanism is only the governable power appliance attached to the foundation brake gear. Without a reliable foundation brake gear the brake cylinders and triple valves are inefficient. In order to get a perfect air or hand brake control it is necessary to commence at the foundation brake gear; with that in first-class condition the air brake and hand brake mechanism can produce the results they are intended for—to stop or control a train under all circumstances. It would seem almost a criminal expense to operate any power or hand brake with improper adjustment. With the present unsettled labor conditions the improvement so much needed in order to obtain better brake regulation by manual labor seems to be more remote than ever before.

Damage to cars and lading, one of the greatest of all losses in the operation of railroads, can by concerted efforts be gradually eliminated by introducing automatic devices for regulation of the brakes.

It is needless to enter into details of the vast amount of property and injury losses occurring every day, both to trains running over the road and cars switched around terminals and yards. Recently an officer of one of the large eastern railroads reported that in the first week in April, 1915, the lading damage alone on his road ran into five figures, and during the first week in April, 1920, it increased to 29 times the amount in 1915. The damage to property outside of lading is another matter for which some staggering figures could be shown no doubt. Probably poor brakes have a great deal to do with it. Much damage to lading occurs in classification and hump yards. Improperly adjusted brakes permit long brake chains, which also mean long piston travel, producing a bad acting air brake and at the same time an unreliable hand brake, their efficiency having been reduced in this manner in many cases as much as 75 per cent, so that the men who are riding these cars are unable to control them with the braking power on a loaded car often as low as eight per cent. Cars with bad brakes go down the hump striking cars standing still at high speed, which causes most of the damage which occurs both to rolling stock and lading, due to improperly adjusted brakes.

When the trains are running over the road with all kinds of piston travel and all kinds of lading these conditions will invariably produce shocks often as great and more destructive than those done by single cars bumping into each other in hump yards. That this is the truth cannot very well be disputed, so that the only way to remedy this defect is to insure uniform predetermined piston travel, allowing every brake cylinder to do the same work in the same time, both in applying and releasing. Short travel develops high pressure quickly and long travel low pressure very slowly, and here is where the evil arises. There never can be more than one safe remedy to overcome this property and damage loss—that is to insure that very brake cylinder piston travel be automatically regulated to one common standard.

We have relied for 50 years on human agency. Has not the time now arrived when it would be advisable to begin the employment of an automatic device and see if this most vital problem cannot be better solved in this manner?

WHAT A LOCOMOTIVE COSTS EACH DAY:—According to a computation made by the Emerson engineering organization, each railroad locomotive in the United States costs $84.31 a day more to operate than the revenue it yields in return. In the Eastern section, according to this computation, the daily operating cost averages $296.63, and the revenue $206.37. In the South the operating figure averages $292.82, and the revenue $208.60.—*Erie Railroad Magazine.*

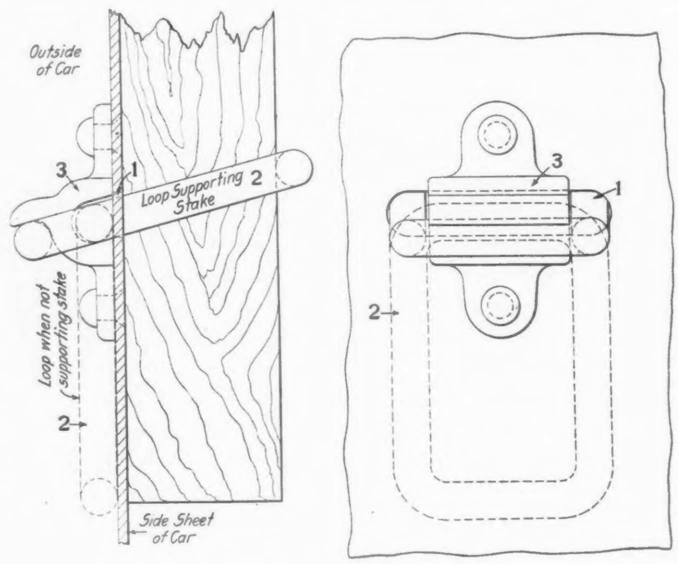
DROP LOOPS TO SUPPORT STAKES INSIDE GONDOLA CARS

BY W. J. KNOX
Mechanical Engineer, Buffalo, Rochester & Pittsburgh

Railroad gondola cars are used principally for the transportation of coarse and bulky freight, such as pig iron, steel billets, lumber, pipe, structural work, etc. When loaded with lumber, pipe, poles and similar materials, which extend above the top of the sides and ends, it is necessary to provide temporary stakes, and this type of car is equipped with permanent stake pockets at either the outside or inside face of the side walls.

For cars with wooden sides the construction usually permits application of the pockets to the outside, while for steel sides the pockets are at the inside of the car. Placing the usual rigid stake pockets at the inside has been found undesirable because they are bent and broken and rendered useless by ladings of billets, pig iron and other heavy and bulky commodities and shifting loads.

To overcome this trouble a number of so-called collapsible stake pockets have been designed. These are supported at



Drop Loop Stake Supporter

the inside of the car by some form of hinge, and when dropped and out of use the projection from the side wall is decreased and to some extent the hazard of damage is lessened, but by no means prevented. By the arrangement represented by the drawing, when the drop stake pocket is not in use supporting a stake at the inside of the car, it hangs suspended at the outside without projection of any kind at the inside, and therefore cannot be damaged by the lading.

Referring to the illustration, at a position where it is desired to locate a stake, a slot *1*, a little larger than the over-all width and thickness of the loop *2*, is cut through the side sheet of the car, and over this, with the loop in place, is riveted the supporting bracket *3*. The full lines indicate the position the loop occupies and how it is carried by the bracket when employed to support a stake. When the stake is removed the loop is slid through the slot to the outside of the car and hangs suspended from the bracket in the position shown by dotted lines.

NON-COKING COALS.—Experiments conducted at the University of Illinois on low temperature carbonizing of coal indicate that the so-called non-coking coals of Illinois may be advanced one of these days into the class of coking coals. Working at 750 deg. C., the gas produced was high in calorific value; the tars were of unusual interest.—*Scientific American.*

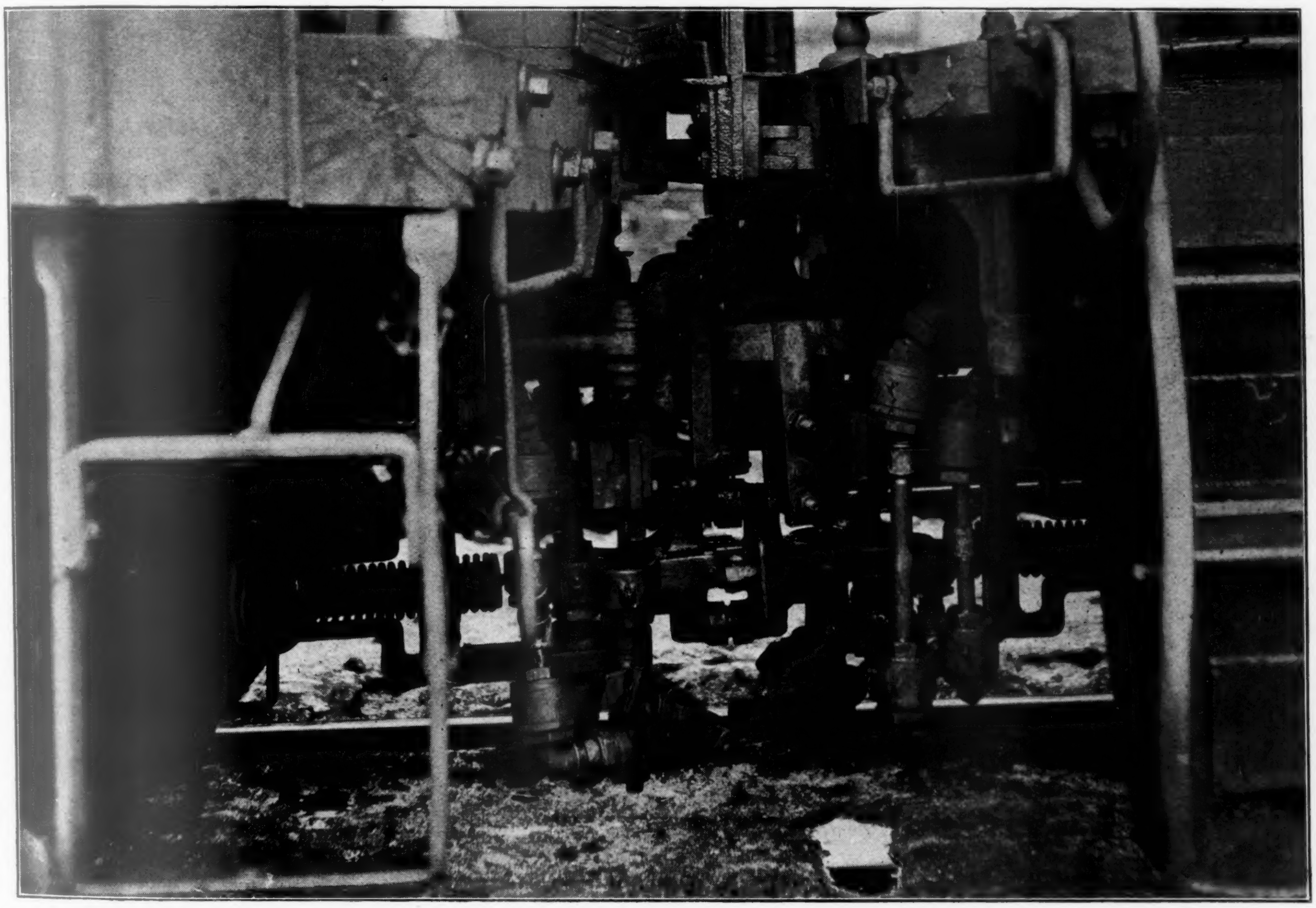
THE BEAHM AUTOMATIC TRAIN PIPE CONNECTOR

Principal Features Are Pin and Funnel Alining Device and Provision for Coupling to Air and Steam Hose

An automatic connector for train pipes, which embodies several interesting features, including a unique method of interchange with cars having standard steam and air hose, has been developed by Peter Beahm, Altoona, Pa., and was applied for test purposes under the direction of the Railroad Administration. The connector differs from other types in the gathering arrangement, in the method of attachment to the coupler and in the means employed for coupling to cars not equipped with connectors.

The connectors on adjacent cars are alined by means of a pin on the horizontal center line of the connector and some distance to one side, and a funnel on the opposite side arm of the coupler by a set screw. The rear portion of the frame consists of a bracket provided with two vertical slotted plates. This bracket supports the main connector frame, which is provided with slotted projections having teeth to engage the bracket of the main frame. Thus the height of the connection can be adjusted independently of the coupler.

The main connector frame has two parallel horizontal members which terminate in a yoke having a boss at the center to receive the rear end of a coiled spring. The vertical guiding stem carrying the connector head fits in a slot in the upper portion of the frame and the carriage for the connector, which contains the gathering device and the parts,



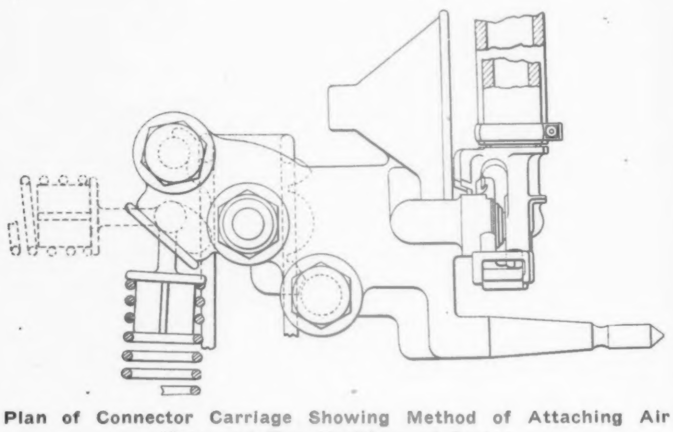
Cars Equipped With Beahm Connector Coupled Together

having a rectangular opening leading to a central cylindrical opening. The funnels guide the pins so that the cylindrical end of the pin will enter the bore of the funnel. The ports in the connector are so located that they come into contact just before the couplers close and are held to their seats by the compression of coiled springs.

The bracket supporting the connector spans the head of the coupler and is held in place by a long knuckle pin. The bracket is so arranged that in case the pin breaks it is still held in position and the connector cannot fall to the track. The supporting bracket also carries an arm, on the end of which is a shoe, the shoe being clamped against the guard slides upon the lower frame member. On the rear face of the carriage is a socket into which fits a knob carried in the outer end of the coiled spring, which extends to the rear of the yoke. The spring holds the carriage at the forward end of the yoke, where its travel is stopped by the stem engaging the outer end of the slots. The socket and boss are offset slightly from the center line of the carriage and the form of the slot is such that pressure of the spring will hold the connector ports either on the center line of the car coupler or at a position approximately at right angles to the center line. The carriage is provided with three channels, the center one terminating in the air brake supply port, the

others leading to the upper air signal port and the lower steam heat port, all three being in the same vertical plane. On the ends of the carriage opposite the air brake and signal ports are lips provided with recesses for receiving the lugs of the standard air and signal hose couplings.

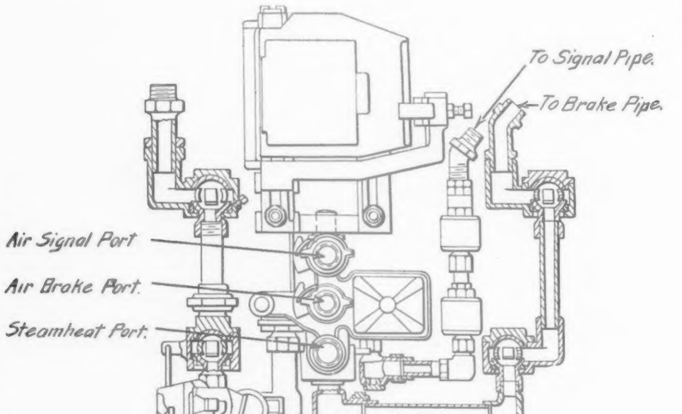
The channel for the air brake connection leads to the rear of the carriage, where it enters a vertical passage, which is closed at the upper end by a plug, while the lower end carries the condensation valve. This port is also connected by horizontal and vertical ball jointed pipes to the air



Plan of Connector Carriage Showing Method of Attaching Air Hose and Two Positions of Spring

brake line. The air signal pipe connections are similar to the air brake connections, except that no condensation valve is provided.

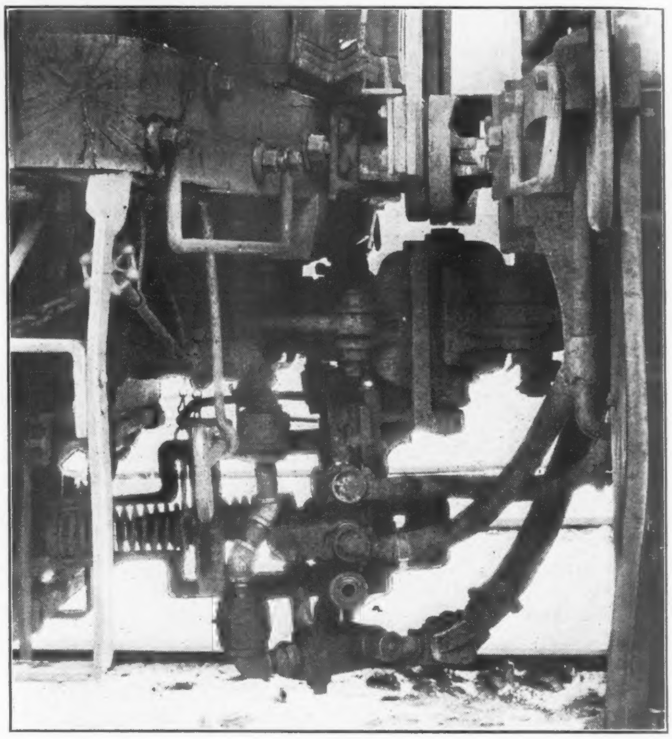
The steam heat connection is carried on the opposite side from the signal connection. A vertical pipe from the carriage leads to the condensation outlet valve and a casing having a hole for the reception of a plug cock and an outlet through the cock, which is connected to the steam heat line by flexible jointed pipes similar to the air brake and signal connections. The plug cock in the steam inlet casing carries a standard steam heat coupling, which is connected to a



End Elevation of Connector Showing Piping Arrangement

port in the key. When the cock is in the normal position and the carriage is in line to couple with connector-equipped cars, the steam passes through the cut-away portion of the cock directly to the port. In this position no steam can pass out of the steam hose coupling and it is held in place by a link attached to an arm on the steam pipe connection. When the connector is used with the ordinary form of coupler the coupling and the cock are turned through a half circle, when the port assumes a position that prevents the steam escaping to the port in the face of the carriage and opens a passage from the steam line through the steam hose coupling. The carriage can then be turned at right angles to the coupler center line, thus allowing air brake and signal hose to be connected to the respective ports.

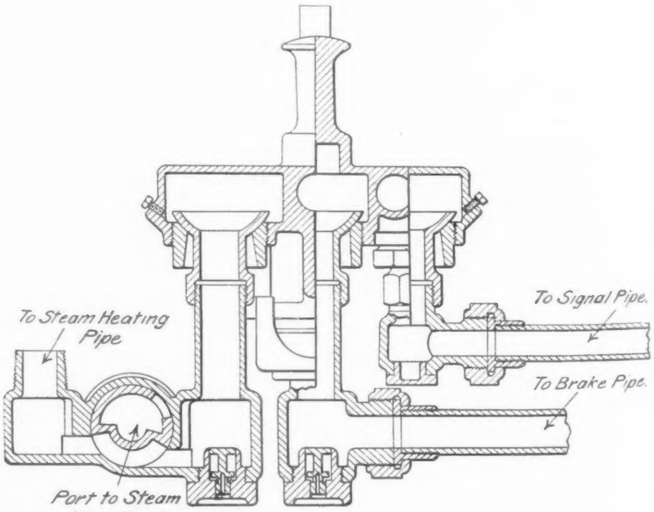
A special feature of the connector ports is the metal coupling ring which is provided with several concentric grooves.



Position of Parts When Coupled to Car Having Standard Hose Connections

In case dirt lodges upon the smooth portion of the ring the action of the opposing connector will cause it to be rubbed into the grooves, thereby eliminating leakage.

The connector, as will be noted, provides a complete metallic connection throughout the train. The joints in the carriage and the pipes are formed by removable seats into which are



Details of Connections to Coupler Carriage

seated hemispherical joints having a limited angular movement. These joints have no packing and are kept tight by the weight of the attached parts and the pressure acting upon them. This form of joint is an earlier invention of the originator of the coupler.

THE INSPECTION OF FREIGHT EQUIPMENT

Handling Weak and Defective Cars. Preparing Equipment for Refrigerator and Heater Service

By L. K. SILLCOX

General Superintendent Motive Power, Chicago, Milwaukee and St. Paul

IT has been found that bad-order cards on cars are sometimes removed by malicious persons and in some instances have been washed off by heavy rain. In order to overcome the embarrassment caused by the cards being removed, inspectors will arrange hereafter not only to card the cars, but also to mark them on both sides with chalk.

If a car has penalty defects or other safety appliance defects it should read "Bad Order, Safety Appliance Defects, Steps Missing," etc., or in case of defective draft gear, sills, etc., it should read "Bad Order, Handle With Care." These markings should appear on both sides of the car, so that there will be no opportunity for switchmen or trainmen to claim that the cars were not marked bad order.

Switching Defective Cars

Defective freight cars should not be switched in with good serviceable cars, in order to avoid damage to the serviceable cars. When defective freight cars are shopped out in the transportation yard, they should be placed on tracks designated for such cars, avoiding frequent handling of the defective cars and preventing further damage.

Location of Cars in Trains

Section 988 of Standard Rules and Regulations of the Operating Department reads as follows:

"The following cars, loaded or empty, will be handled next ahead of the caboose, giving preference in the order shown, except that at least one car must be handled between a flat car loaded with rails and the caboose. 1. Bad order cars; 2. Bunk cars; 3. All wooden flat cars; 4. Coal cars with temporary sides; 5. Oil and water tanks, except all steel or steel underframes.

"In addition to this, loaded or empty cars of 40 tons capacity or less with short draft timbers should be switched to the rear end of trains."

Switching Wooden Cars to Rear of Train

Car inspectors will mark all cars with short draft timbers for switching to the rear of the train when loaded and empty, provided they are to operate in trains of 65 cars or over. Car inspectors must be instructed to chalk-mark all cars with short draft timbers suitably on both sides, in plain legible writing stating whether they are to be switched to the rear, and if a load, marking them to be cut out when empty, besides taking down the car number and the date. All concerned must co-operate to see that cars are properly loaded to avoid embarrassment in service.

Switching Weak Cars

In cases where short draft timber cars are placed in long trains, and experience has dictated a policy of care, due to characteristics of the line, and it is felt economical to switch out weak constructed and equipment with short draft timbers to rear of train, this should be done. As a general plan, no train containing 65 cars or more should have cars with short draft timbers placed except at the rear. Cars which are to be switched to the rear will have the initials W. C. six inches high placed on the side of the car above each transom, this standing for weak construction.

Icing Refrigerator Cars

Standard Rules Regarding Re-Icing of Cars Containing Meats, Packing House Products, etc.:—The following rules must be observed:

For straight or mixed cars of fresh and frozen meat or dressed poultry, use crushed ice with salt.

Packing House Products:—Butter, eggs or cheese must be re-iced with crushed block or lump ice, with or without salt in accordance with railroad billing.

1. Quantity and preparation of ice, and grade of salt: Ice must be thoroughly cleaned by flushing with water, thus removing all foreign substances to prevent clogging of drains.

Description of Crushed Ice: Ice should be no larger than a man's fist.

Description of block ice: Ice should be broken in chunks weighing approximately 50 lb. and permitted to fall into tanks loosely.

Description of lump ice: Ice should be broken in chunks of 15 or 20 lb. When the railroad billing specifies the use of salt, follow the salting method described in paragraph four below.

Description of Salt: No. 2 rock salt must be used in accordance with instructions on railroad billing. Foremen should anticipate their requirements for salt sufficient in advance to insure an adequate supply.

2. Hatch covers and plugs removed: Extreme care must be used in the removal of hatch covers and plugs to prevent all foreign substances from dropping into tanks. Uncover only such tanks as can be immediately filled to prevent any unnecessary exposure. Plugs and covers are to be replaced at once after re-icing is completed. Plugs are to be fitted evenly and tightly in the tanks by lightly tamping with the tamping pole.

3. Release of excess brine: If tank valves do not work, excess water must be removed from tanks before re-icing is attempted. This can be accomplished by using a hand pump or bailing out with buckets; if the valves do not work, the next icing station must be notified by wire so that they can be prepared to remove promptly the excess brine before re-icing.

The A. R. A. Rules of Interchange, rule 3, paragraph f, require all beef refrigerator cars to be equipped with brine retaining valves to prevent brine dripping along the right of way between icing stations. When the plugs are pulled, excess brine is automatically released. Considering the large number of cars now equipped with this device, and the rule requiring all such cars to be equipped as fast as possible, it is necessary that each icing station procure a hand pump. Excess brine must be removed from the tank before re-icing is attempted.

4. Tamping and salting crushed ice: Foremen should see that a wooden tamping pole is used, and under no circumstances should they permit pike poles or poles with metal ends to be used. The tamping pole should be inserted into the old ice which should be thoroughly stirred and tamped to settle it to the bottom of the tank. After tamping, one third of the salt required in the re-icing is to be properly spread over the old ice before any more new ice is used. Then the tanks are to be filled with ice and the balance of the salt evenly spread on top of the new ice. The men icing the cars should again use the tamping pole vigorously to even off the top of the ice and start the salt working. They should see that the space between running boards is filled, but should not fill tanks above the top of the saddles.

5. Stations not equipped with an ice crusher, should secure the necessary wooden mauls and ice crushing boxes to insure efficient re-icing. Under no circumstances should ice be broken on the roofs or in the tanks of cars.

For ready reference the following table can be used to determine the amount of salt in pounds based on the quantity of ice supplied.

Salt Required for Various Percentages and Weights

Ice Pounds.	Five percent salt; lb.	Seven percent salt; lb.	Eight percent salt; lb.	Ten percent salt; lb.	Twelve percent salt; lb.	Fifteen percent salt; lb.
500	25	35	40	50	60	75
600	30	42	48	60	72	90
700	35	49	56	70	84	105
800	40	56	64	80	96	120
900	45	63	72	90	108	135
1,000	50	70	80	100	120	150
1,100	55	77	88	110	132	165
1,200	60	84	96	120	144	180
1,300	65	91	104	130	156	195
1,400	70	98	112	140	168	210
1,500	75	105	120	150	180	225
1,600	80	112	128	160	192	240
1,700	85	119	136	170	204	255
1,800	90	126	144	180	216	270
1,900	95	133	152	190	228	285
2,000	100	140	160	200	240	300
2,100	105	147	168	210	252	315
2,200	110	154	176	220	264	330
2,300	115	161	184	230	276	345
2,400	120	168	192	240	288	360
2,500	125	175	200	250	300	375
2,600	130	182	208	260	312	390
2,700	135	189	216	270	324	405
2,800	140	196	224	280	336	420
2,900	145	203	232	290	348	435
3,000	150	210	240	300	360	450

Preparation of Cars for Heater Service

All ice and inflammable matter must be removed from bunkers and drip pans, all doors and hatches tightly closed. Bulkheads must not be lined with paper when heaters are to be placed in the bunkers. In order to permit circulation of air, the drain pipes should be cleaned and left open before and during the process of loading, as well as while cars are in transit. When cars with ice tanks are used, heaters should be placed in ice bunkers of cars and securely braced.

Charcoal Heaters

When refrigerator cars contain ignited charcoal heaters, placed in ice tanks, the hatches must be left open a few minutes before entering the tanks or bunkers of the car. All persons are warned against remaining in cars with doors or hatches closed while charcoal heaters are burning and to use caution on entering cars under such conditions.

Care of Charcoal Heaters

In selecting and preparing fuel for both the Cole and Baxter types of heaters, charcoal of good quality, absolutely dry, free from knots and reduced to the size of a walnut should be used. The efficiency of the heater depends largely upon using charcoal of proper quality and size. Charcoal dust must not be used in the magazine. Charcoal must be stored where it will keep perfectly dry.

Operation of Cole Heaters

(a) To fill the magazine shove in the cut-off slide and fill the magazine with prepared charcoal, free from dust, as dust will choke down the fire. The cover of the magazine must be kept closed absolutely tight while the heater is burning. This is essential to prevent a draft of air from the fire pot up through the magazine. When it is necessary to open the cover to replenish the charcoal, that must be done quickly and the cover again closed without delay.

(b) In order to start the fire, remove the fire pot and fill it not to exceed 2/3 full of clean charcoal free from dust. Replace the fire pot, remove the starting lamp through the ash pit hand door and saturate with alcohol. Light and replace the starter, then put on the magazine section and lock the heater with the pin. Pull out the slide (secured by a pin) in the magazine and see that the fuel feeds down and close the ash pit hand door.

(c) In regulating the draft slide, set it either at full heat or slow heat as conditions require. Remember that the fuel always heats up considerably hotter during the first 12 hours with either draft position.

(d) Kerosene or papers can be used in starting the fire, but will cause considerable smoke until burned out. Be sure that the heater has a good start before placing it in the car. The heater can be nailed to the floor, swung from chains from the ceiling of car or anchored in the bunkers of the car by chains. The ash pit door must always be closed except when removing ashes or the starter. The top feed lid must always be closed tight to prevent burning in the magazine. To extinguish the fire, simply remove the pin and shove in the cut-off slide. Remove the ashes at least once a week and never dump them on the car floor nor on wooden platforms or ties. Some ashes retain fire hours after dumping.

Operation of Baxter Heaters

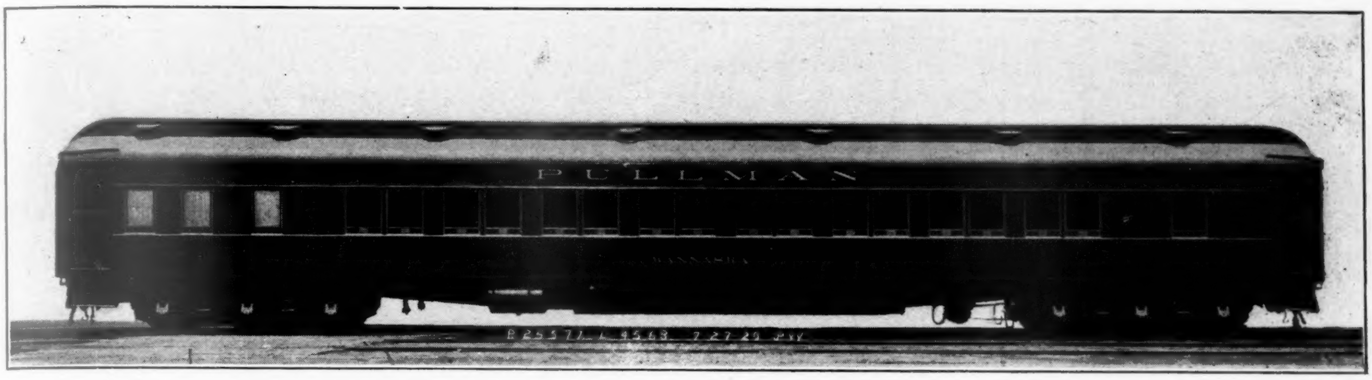
The fire in the heater can be started in the car, but the door or hatches in the car must be left open to give a draft and allow the escape of gas. It is better practice to start heaters on platforms in the open air.

The procedure is as follows: (1) Remove the magazine by unfastening the hasps at the bottom and lifting off. (2) Punch a hole in the center of the paper starter and light there, then place on the grate in the bottom of the fire pot and put three or four handfuls of charcoal or briquets on the starter and let it burn a few minutes. (3) Fill the fire pot and let the blaze show before putting on the magazine. This will usually take about ten minutes. (4) Put on the magazine and fasten the hasps at the bottom, then remove and fill the cover, shaking a little to fill to capacity. Replace the cover quickly and see that it is on tight. Do not use charcoal dust in the magazine. If the heater has a shut off slide, pull it out and place a pin to keep it open.

Handling Road Work

Men doing road work often cannot get into their home station without making unavoidable overtime, due to lack of convenient train service. There is only one means to resort to in combating this condition, namely to see that where men lay over at any station, they take it upon themselves to go over any cars which are located adjacent or within easy reach of the car which they repaired, giving them such necessary attention as to fit them for service, besides making every adequate repair within their power to the cars which they were sent out to take care of. Good judgment is necessary and roadmen should be checked up to see how many work cards they deliver showing actual repairs made. They should carry sufficient cotter keys, nuts, small bolts and other items with them so as to provide for any eventuality. In any case, they can take care of the packing on a number of cars without additional material, all of which should be properly reported. All supervisors should interest themselves to the extent of seeing that this matter is followed up from day to day. There is always a proportion of the expense chargeable to transportation accounts, namely, that spent in the attention given oiling and packing of boxes, closing side doors, classifying cars for various loading, etc.; of course, the time actually spent repairing the equipment is chargeable to car repairs.

It is not proper to send men out on the road to repair cars with broken train lines, defective air brake equipment, framing or truck members, if it is at all possible to get the car safely to some repair station by hauling it behind the caboose, care being exercised, of course, to see that loaded cars are not delayed unnecessarily and back-hauled too greatly in case there are no means available for turning the car.

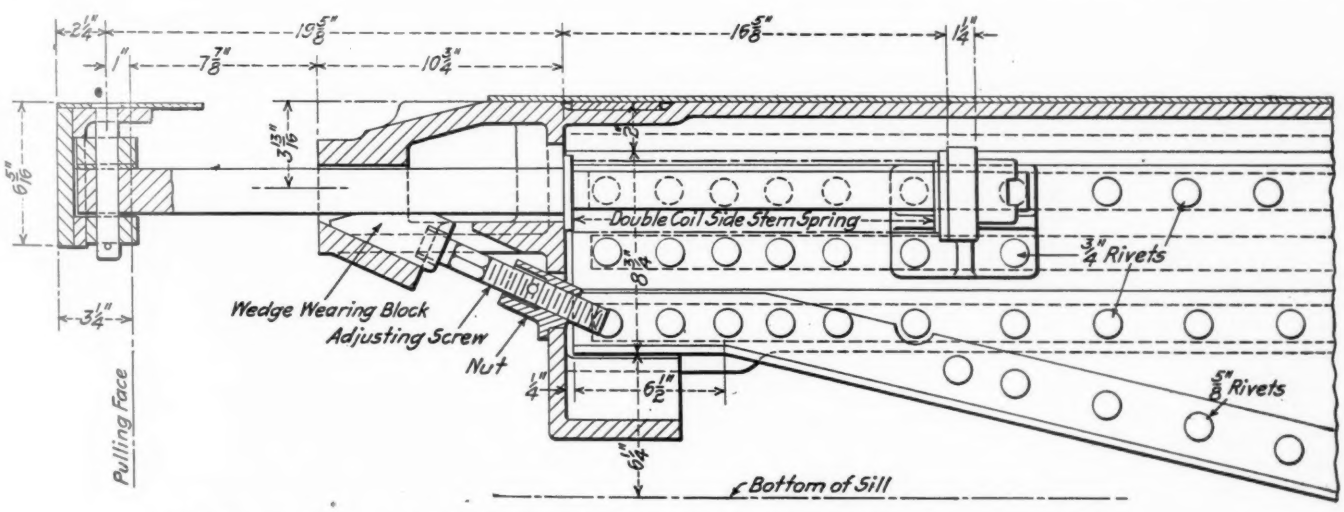


Latest Type Pullman Sleeping Car

IMPROVEMENTS IN NEW PULLMAN SLEEPERS

Changes in Details Which Have Been Developed to Add to the Comfort and the Safety of Travel

ALTHOUGH no changes in basic design have recently been made in its equipment, the Pullman Company has been constantly working on the development of detail improvements most of which have had for their object an increase in the comfort or safety of the occupants of Pullman accommodations. A number of changes of this nature have been incorporated in the new sleeping cars which the company has been building at its Pullman works, Chicago, since the return of the railroads to private operation.



Section Through the Lower Buffer Side Stem, Showing Wear Adjusting Screw and Wedge

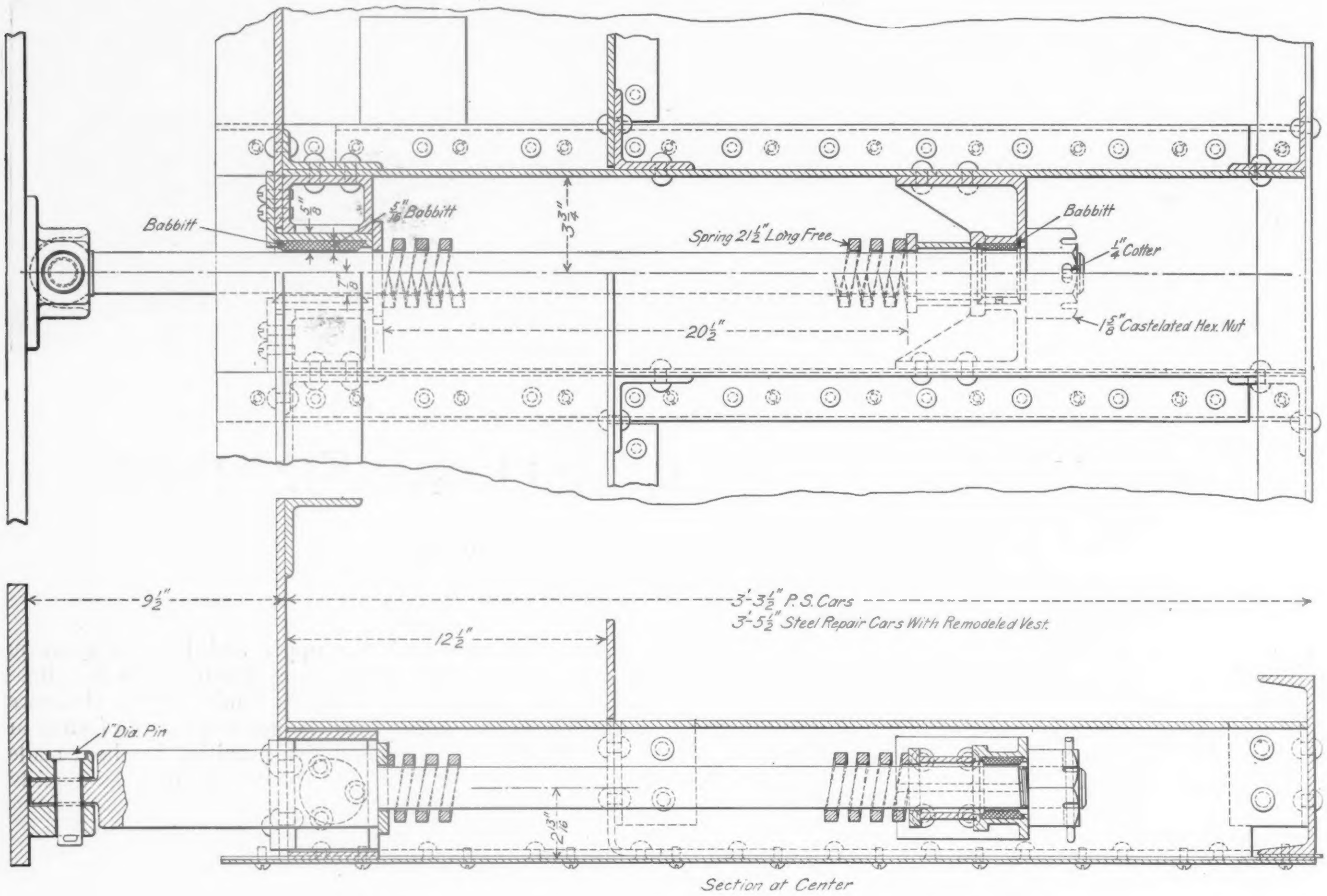
Diaphragm Mechanism

The metal diaphragm is now a standard feature of Pullman car construction and cars equipped with these diaphragms have been in service several years. The clearance between the diaphragm and the sides of the narrow metal pocket within which it telescopes is necessarily limited. But the method by which these diaphragms have been supported has permitted considerable lateral motion at the top and this has tended to increase rapidly as the buffer side stems wear into the surfaces of the openings in the platform end casting through which they pass. These conditions have resulted in the constant slamming of the diaphragm against the sides of the pocket and the noise thus caused led to numerous complaints.

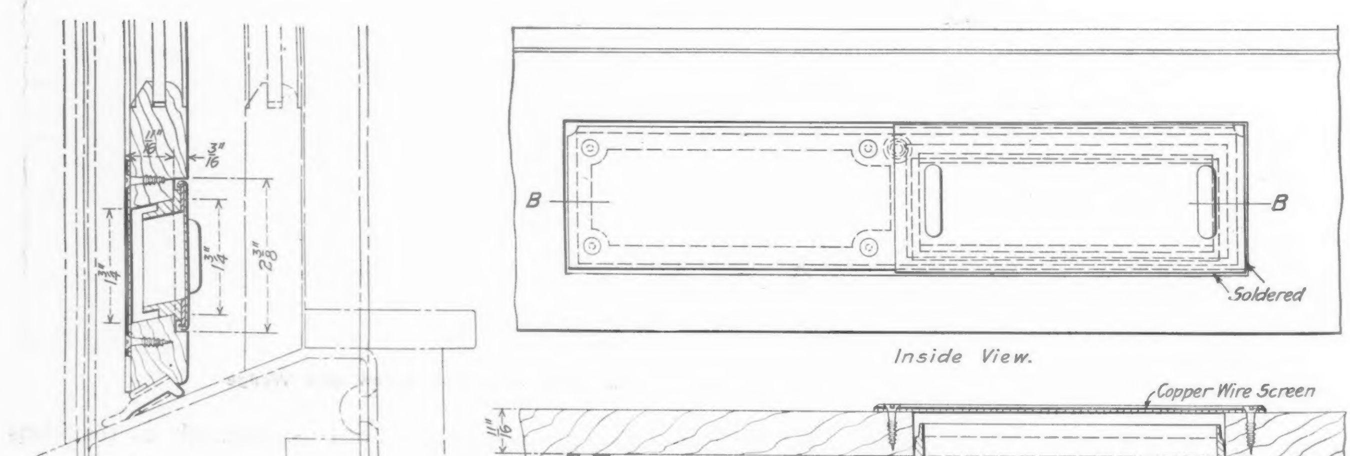
In the new cars both the upper and lower diaphragm buffer mechanisms have been arranged to maintain the alinement of the diaphragm within the limits of the clearance in the pocket, thus eliminating the greatest source of noise at the ends of the car. In this design provision has been made to take up wear so that the diaphragm may be readily restored to its normal position as frequently as conditions require.

The height of the diaphragm is controlled by the surfaces on which the buffer side stems rest. In the new cars these stems are supported on adjustable shims or wedge blocks let into the platform end casting and adjusted as shown on one of the drawings. The adjusting device consists of three pieces, the shim, the adjusting screw and the nut. The parts are readily assembled or removed by turning back the adjusting screw into the nut, which permits the nut to be inserted or lifted out of the opening in the casting. The shim is then free to drop out. When properly adjusted the screw is prevented from turning back by a cotter which passes through slots in the extended portion of the nut and one of two holes drilled through the screw at right angles to each other.

Upper diaphragm buffers either of the semi-elliptic spring type or of the stem and coil spring type have never pro-



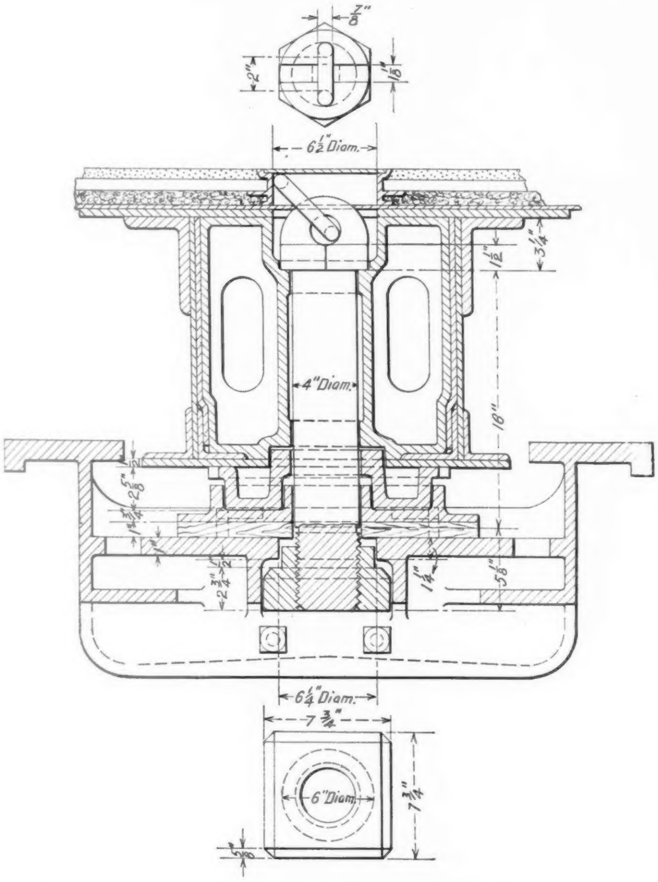
Single Stem Diaphragm Mechanism With Babbitted Center Plates



Ventilator Applied to Loweer Rail of Outside Sash

vided a satisfactory means of centering the top of the diaphragm. Consequently the entire reaction from the lateral force at the top of the diaphragm caused by the swaying of the cars has been taken by the buffer side stem supports. This has caused excessive wear and a rapid increase in the lateral movement at the top of the diaphragm.

To overcome this a single stem upper diaphragm mechanism has been designed in which the stem is restrained between lateral bearings where it emerges from the end of the car. These bearings are removable malleable iron castings faced with babbitt, inserted from the outside and held in



Locked Center Pin With Full Diameter Effective for Stress Resistance

place by machine screws applied through flanges to the end of the car. When worn they are readily replaced, and after rebabbitting are ready for further service. The buffer stem rear guard is also lined with babbitt, but this casting is riveted in place and is not designed for removal between shoppings.

Sash Ventilators for Lower Berths

Although an extremely simple device, the sash ventilator which has been placed in the lower rail of the outer or storm sash of the car windows is one which immediately appeals to the occupants of lower berths and it has already been the object of a number of individual expressions of appreciation from the traveling public.

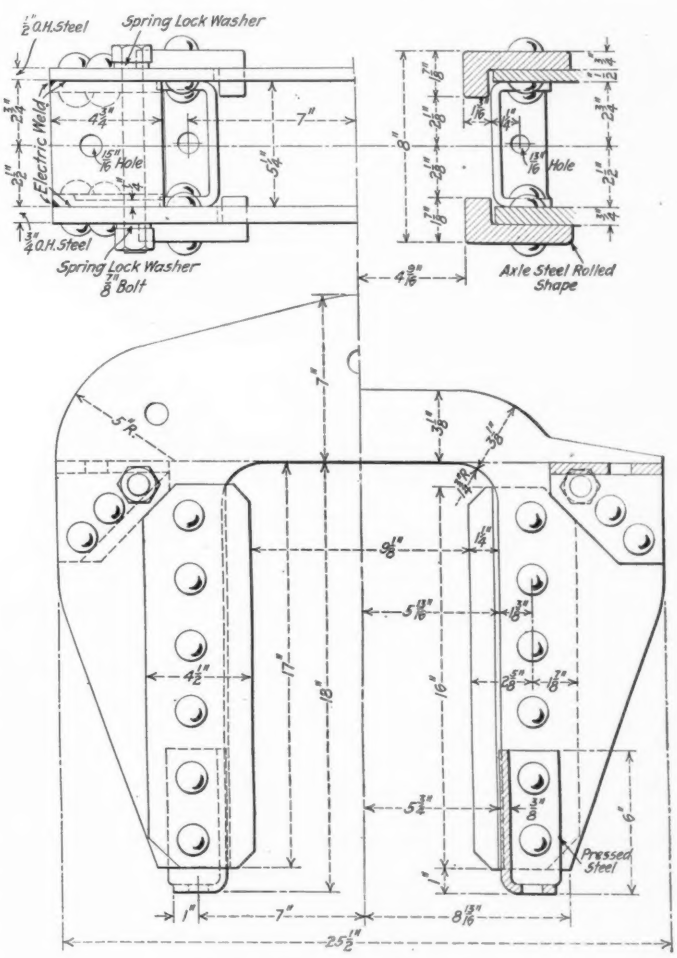
The difficulty in always securing satisfactory ventilation and temperature regulation in lower berths during the seasons when heat is required and the windows are normally kept closed is well known. Under these conditions the only recourse of the occupant of a lower berth who wishes additional ventilation is to raise the inner sash and then slightly open the outer sash, adapting some portion of his personal belongings to serve as a stop to prevent it from working shut. The ventilator furnishes a screen protected opening, closed with a horizontally operating slide, which provides easy and close regulation of the amount of air admitted.

The Locked Truck Center Pin

While it is impossible to design equipment strong enough to resist destruction under all conditions of collision impact, it is generally recognized that anything which will tend to hold the underframes in the same horizontal plane will exert a powerful influence in the prevention of telescoping, the form of destruction usually responsible for the greatest loss of life in train accidents.

The use of a locked center pin as a means of resisting the tendency of one underframe to climb over the top of another has received considerable recognition and at least one self-locking center pin has been developed. The locked center pin is effective only so long as it holds the truck and car body together. The self-locking type is open to the possible objection that the full area of the pin section is not available to resist tension or shearing stresses and therefore under certain conditions might not be as effective in preventing a separation of the truck and car body as a pin of solid section.

These considerations have led to the design of the center



Built-Up Pedestal for Pullman Trucks

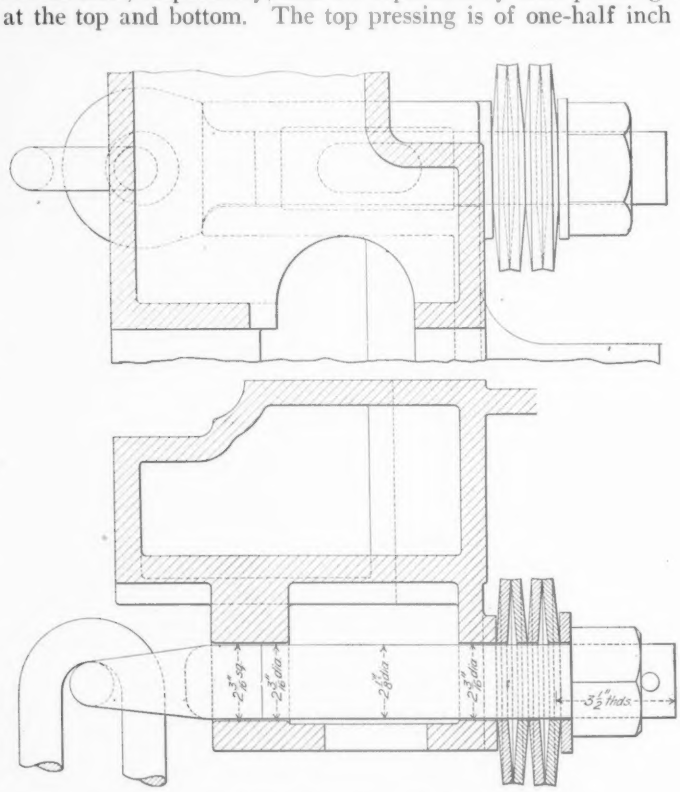
pin shown in one of the drawings. The pin is a forged steel bolt four inches in diameter with a shallow hexagonal head and a square nut of special design. The head sets in a shallow hexagonal socket at the bottom of a pocket in the center sill filler casting. The nut is placed in a square recess in the under side of the truck bolster and two ⅞-in. bolts applied through flanges of the bolster casting hold it in position when the center pin is not in place. In applying the bolt it is dropped in place and screwed into the nut,

which is held in sufficiently close alinement by the square recess in which it is placed to prevent any difficulty in starting the threads. When drawn up as far as it is possible to turn the bolt, the head is brought into register with the socket and dropped in. This locks the bolt and nut except for the slight turning of the nut due to the curving of the trucks, which it is expected will prevent the nut from sticking and causing trouble when removal is necessary.

The use of check chains has been dispensed with and a plate on which is cast in raised letters the legend, "Locked Center Pin, Remove From Inside," is attached to both side frames of each truck between the center and inner pairs of wheels.

Built Up Truck Pedestals

In order to overcome the occasional failures of cast truck pedestals which have occurred in service a pedestal built up of plate and rolled and flanged sections has been designed and applied to the new equipment now being built. The outside and inside plates are of ¾-in. and ½-in. open hearth steel, respectively, and are separated by steel pressings at the top and bottom. The top pressing is of one-half inch



Application of Safety Chains With Spring Washers

material and is electrically wedled and riveted in place. The lower pressing is of ⅜-in. material. The jaw faces are formed by two rolled steel pieces of special angle section which are riveted to the outside of the plates with the short legs turned in. These pedestals are built up and applied as units.

Safety Chain Application

One of the interesting details in the construction of these cars is the use of spring washers on the safety chain anchor bolts. The application is shown in detail in one of the drawings. The washers are 6 in. in diameter and are cupped to a depth of 5/32 in., each, thus providing for a full load travel of the safety chain bolt of ⅝ in. This arrangement, which is common in European practice, acts as a cushion for part of the shock to which the chain and bolt are subjected when brought into action by a failure of the coupler. In the application shown these washers have a full load capacity in the ⅝ in. travel of approximately 50,000 lb.

PREPARATION AND APPLICATION OF JOURNAL BOX PACKING

BY NORMAN McCLEOD

The arrangement for soaking oil is an important adjunct to all modern oil houses. The drawings accompanying this article show three designs of cans and boxes or tanks for soaking and draining the packing, each having its peculiar advantages. The plain box, Fig. 1, and cans shown in Fig. 2, are in extensive use and are satisfactory for properly soaking and draining the packing for cars and locomotives, but are more or less crude in comparison with the method shown in Fig. 3. With equipment shown in Fig. 1 the packing must be handled from soaking compartment

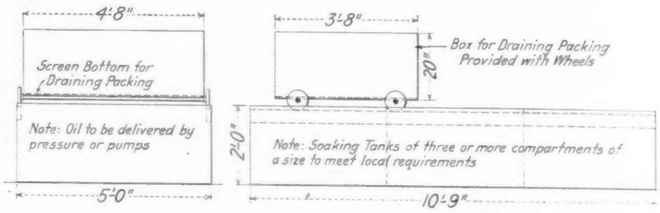


Fig. 1—Soaking Tanks With Portable Draining Boxes

to drainage tray, which becomes a more or less untidy operation, but with the cans, Fig. 2, and vat system, Fig. 3, it is not necessary to handle the packing, except to take it out when it is to be used, as it is soaked and drained in the same compartment.

In Fig. 1 it will be noticed that the soaking tanks are made up of three compartments of a size to meet local requirements, the oil being conveyed to them from the oil storage tanks by pressure or by pump, as desired. Provision is made for a portable tank or box on wheels, as shown in Fig. 1, to facilitate its movement over the various compartments. The bottom of this portable box should be made of a suitable screen, strong enough to sustain the weight of the oil soaked waste. The size of the box as shown is 20 in., by 3 ft. 8 in., by 4 ft. 0 in. This, of course, as well as the size of the soaking tanks, depends on local requirements.

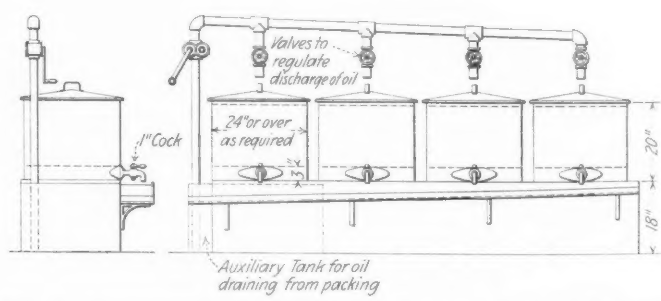


Fig. 2—Arrangement for Soaking and Draining Packing Without Removing from Cans

The arrangement shown in Fig. 2 represents a step in advance of that just described, in that the tanks or cans are separated and are provided with a screen three inches from the bottom of the can, to which the oil returns after percolating through the waste, to be drawn off into an inclined trough by which the excess oil finally reaches an auxiliary tank, shown in dotted lines in the front elevation. If desired, this tank can be provided with a vertical graduated scale, thus allowing a check to be kept of the amount of oil absorbed. Provision is made in this plan for the return of the oil from the auxiliary tank to the soaking tanks by the use of a rotary pump as shown.

In Fig. 3 is shown a more advanced type of apparatus for this purpose, which allows of greater rapidity in soaking

and pressing out all surplus oil, the pressing being done by a portable air cylinder, or by hand power if air is not available. The cylinder is arranged to travel over all the vats, as outlined in the drawing. Each vat is provided with a perforated bottom placed six inches from the base. From this space the oil is drawn through faucets as shown. Provision is made for the oil, which naturally accumulates above the pressing plate, to reach the oil space below, by having three-inch galvanized iron strips, perforated the full length, placed in each corner of the vat as is clearly shown in the plan view.

Each vat should be provided with a scale of gallons so that the amount of oil used may be known if desired. This latter plan is the best for large car receiving and repair yards, and has been used for some time and with most satisfactory results on a number of important western railroads. The arrangement has many advantages and is worthy of consideration for all important oil houses.

The way in which the work is handled has an important bearing on the results secured, regardless of the equipment or the materials used. The method of packing boxes described below and the tools illustrated have proved effective in securing the best results in lubricating cars and locomotives.

Preparation of Sponging or Packing.—The waste must be separated in small quantities, but never rolled in bunches and must not be cut. It must then be submerged in freight or coach oil, according to requirements not less than 48 hours and kept submerged in oil until used. Before using, the surplus oil must be drained off, allowing a sufficient amount to remain, which is approximately equal to three pounds of oil to one pound of waste for freight cars and tenders, and three and a half pounds of oil to one pound of waste for passenger cars. The sponging while being used, must either be turned over periodically in the tank or the oil raised from the bottom of the tank and poured over the top of the sponging to keep all of the waste and oil in the tank properly mixed for use. Old sponging removed from locomotives and cars should be examined and the waste found in good condition should be cleaned, picked apart and again used for packing purposes. In no case should valve oil be used to saturate waste for packing purposes.

Method of Packing Journal Boxes.—All extra oil should be wrung or pressed out of a portion of waste, forming it into a loose rope. This should be packed tightly around the back end of the box, to assist the dust guard in retaining oil in the box and in excluding as much dirt as possible. The box should then be packed with loosely formed portions of the sponging to insure holding it in contact with the journal, being careful not to set it above the center line of the journal. The packing should not be entered between the journal and the side of the box, but should be entered directly under the front of the journal. This packing should extend well out to the front of the journal, as shown in Fig. 4, and should be packed back of the collar.

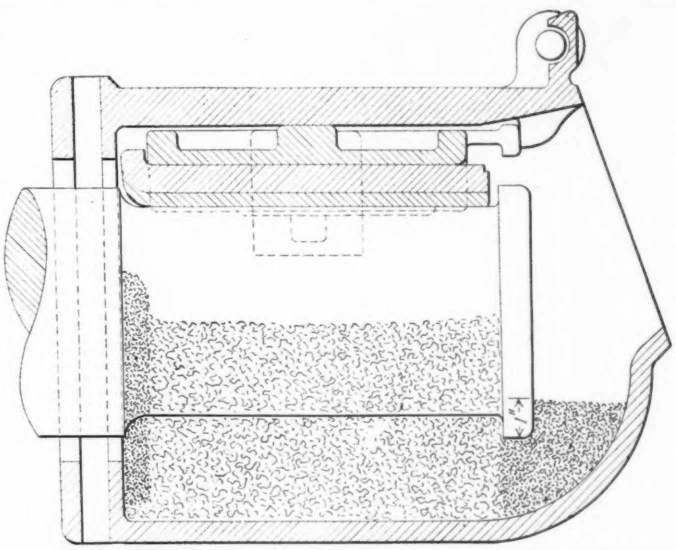


Fig. 4—Arrangement of Water in a Box Properly Packed

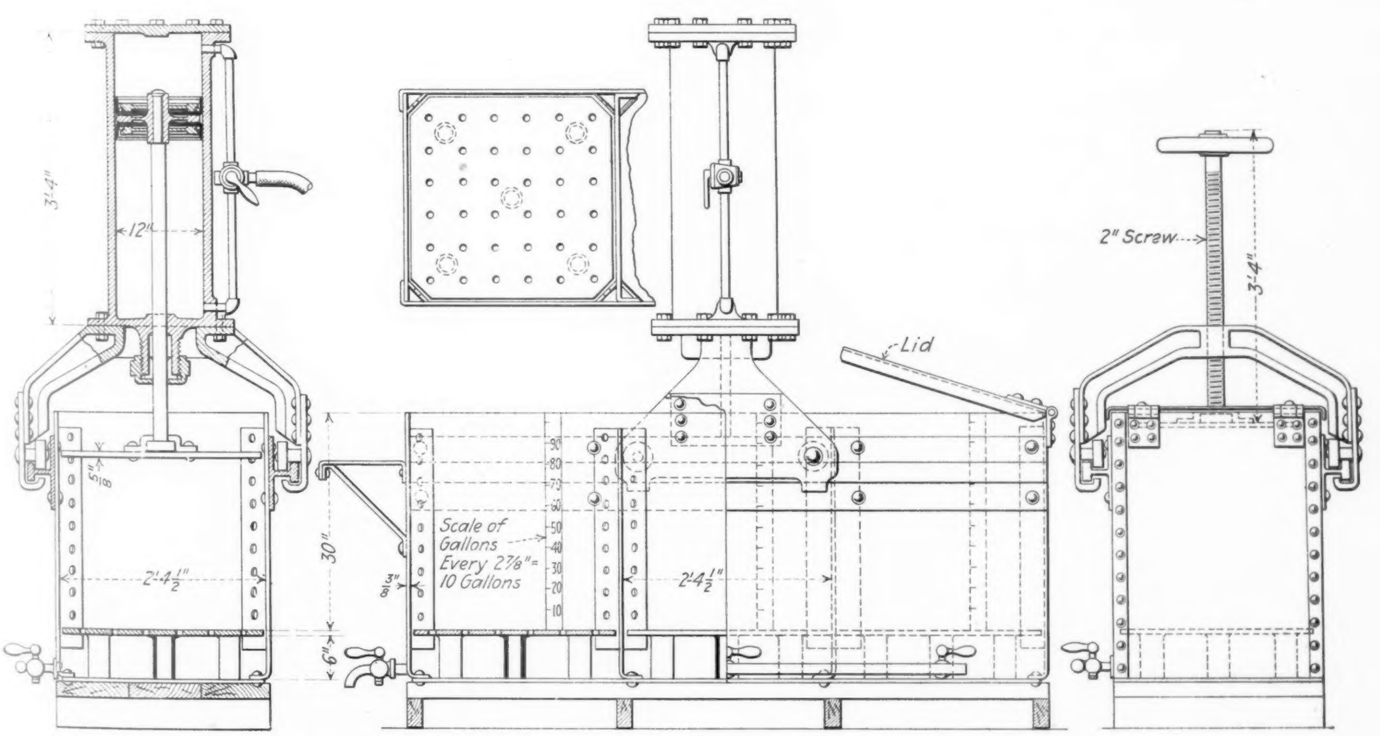


Fig. 3—Tanks Equipped with Press for Preparing Journal Box Packing

The sponging between the end of the journal and the in-

side front face of the box should have no connection with the sponging under or on the sides of the journal, as this sponging affords no means of lubrication to the journal, but is simply to prevent the sponging under the journal working out of position. For passenger and locomotive tender journal boxes the sponging between the end of the journal and the inside front face of the box should be formed of waste in the shape of plugs wound with cord, in order to facilitate their removal for the purpose of examination and setting up of packing.

When old sponging is reclaimed sufficient oil should be added to bring it to the same degree of saturation that is required for new waste.

Figs. 5 and 6 represent a variety of steel packing tools for use in packing car and locomotive tender journal boxes. Nos. 1 and 2 are for use in shops and car repair yards, where this work principally consists of the entire repacking of boxes. Tools 3, 4 and 5 are assigned and extensively used for the proper care and treatment of packing by oilers or inspectors in yards or cars in transit.

Two designs are shown, Nos. 3 and 4, which combine

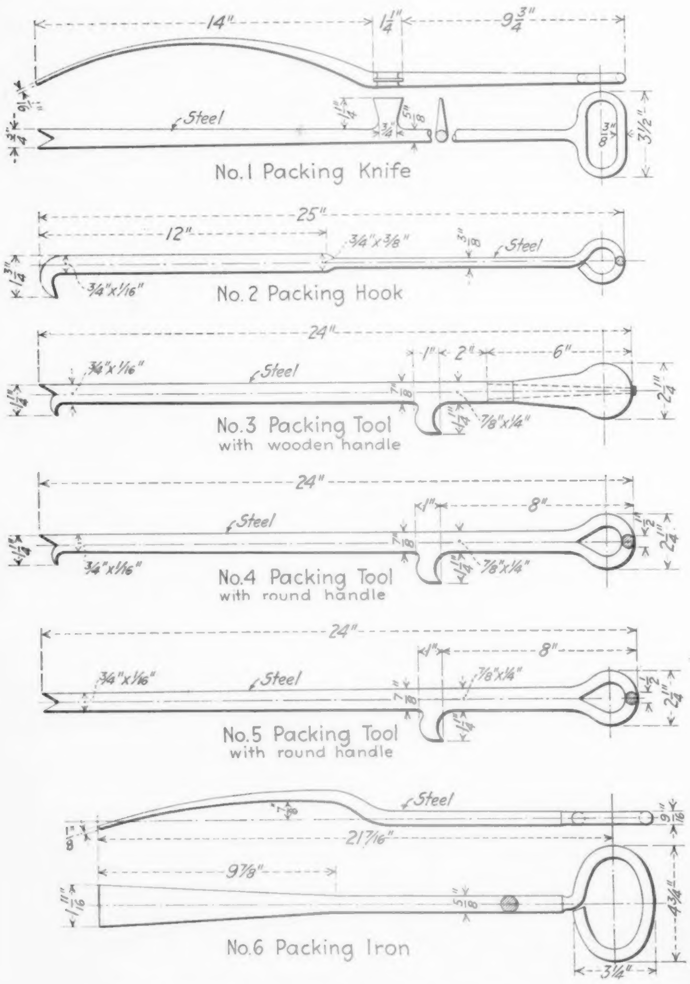


Fig. 5—Efficient Tools for Packing Journal Boxes

the features of Nos. 1 and 2, enabling a man with one tool to either quickly remove surplus packing with the hook edge of the tool, or to loosen the packing on the sides of the box and restore it to its proper position at the rear of the box with the spur edge of the tool. The handles of these tools differ, some preferring the wooden to the metal handle. Tool No. 5 has a V-shaped end and is in very general use in place of tools Nos. 3 and 4. Tool No. 6 has also been found desirable for the treatment of packing boxes.

A tool of either of these designs made of steel, should be used for rapidly and effectively maintaining the packing in an elastic condition and thus avoiding glazing and securing a more rapid flow of oil from the packing to the journal.

Tools Nos. 1 to 6, designated for driving boxes, are used for care of packing in driving box cellars of locomotives,

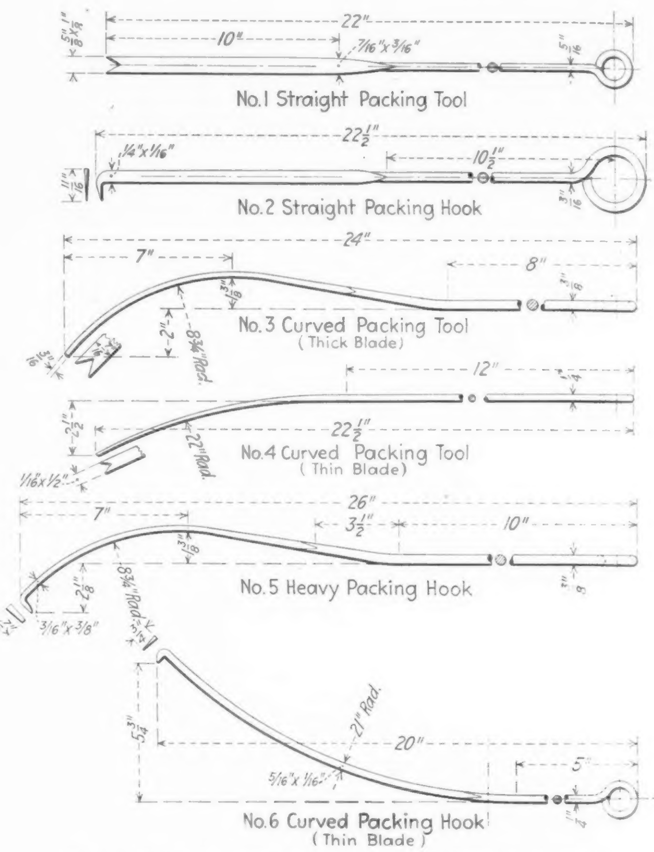
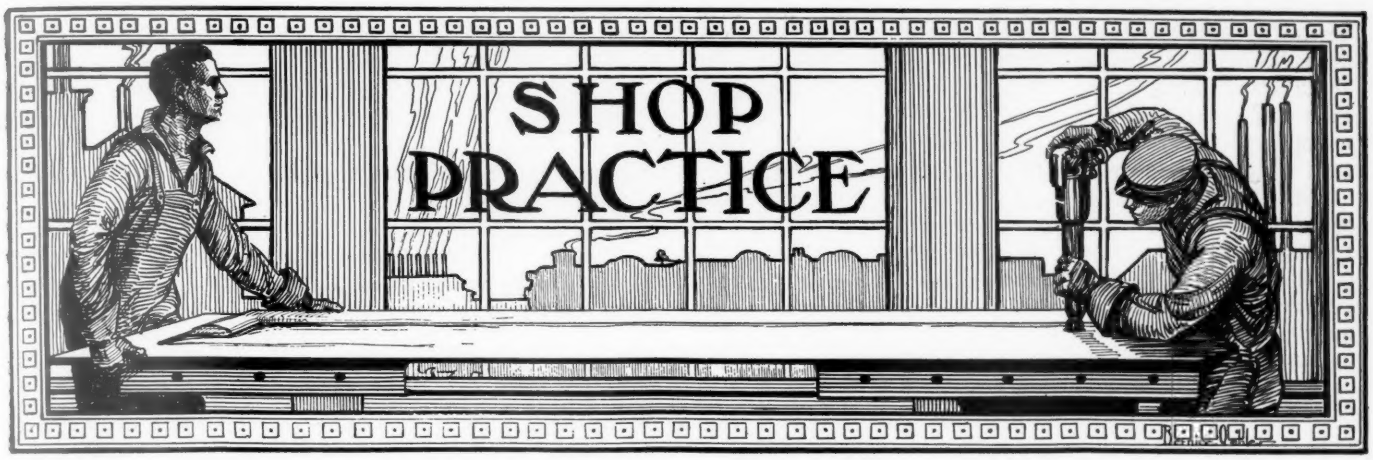


Fig. 6—Packing Tools for Locomotive Driving Boxes

and have been found very effective. Tool No. 6 is used in removing packing drawn up by the journal and caught by the lower edge of the brass; this tool has been found valuable in enginehouses on locomotives in passenger service.

Photograph from Underwood & Underwood, N. Y.

Salvaging Railway Property in Dublin from Freight Cars Which Were Set on Fire by Irish Incendiaries



HACK SAW BLADES AND CUTTING PRESSURE*

Too Little Pressure on Hack Saw Blades Is as Bad as Too Much; Work Must Be Held Properly

ONE of the most important factors in efficient cutting with a power hack saw machine is the maintenance of the proper pressure on the blade during the whole of a series of cuts. Failure among hack saw users to realize this fact causes big waste of blades and time, a waste far greater than is generally supposed. The maximum efficiency is to be found in the saw that cuts quickest and lasts longest; that combines cutting efficiency with endurance. The ability to cut in the shortest time is but one of three

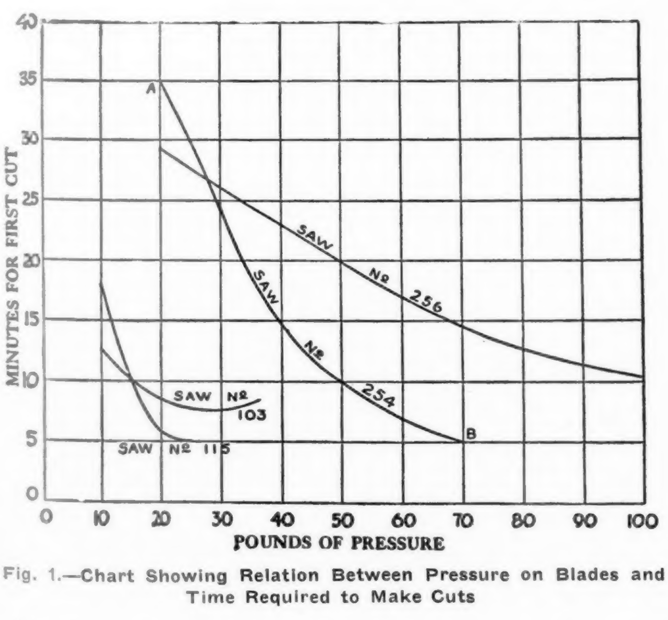


Fig. 1.—Chart Showing Relation Between Pressure on Blades and Time Required to Make Cuts

objects that determine the value of a hack saw and, when time is only considered of value, the chances for a loss of efficiency are exactly two out of three.

The effect of the regulation of weight on the time per cut is clearly shown in a recent test made to determine the results of various pressures on a number of blades. The test results are shown graphically in Fig. 1. In this experiment a new blade was properly placed in a hack saw machine, a piece of 3-in. machine steel put in the vise, the weight set at 20 lb., and a cut made. The time required for the cut was 35 min. Another blade was then placed in the machine, the pressure increased to 25 lb., and another cut made. The time required was 30 min. With the 30-lb. weight, a new saw completed the first cut in about 24 min. Another saw was inserted, the weight increased to 40 lb., and the time of the first cut was reduced to 15 min.

Effect of Too Much Pressure

The next increase was to 44 lb., which is the weight recommended for this particular saw, and a new blade made its first cut in 11 min. 30 sec., which is slightly better than a good average time for a first cut on this size and class of material. The weight was then increased to 50 lb., and subsequently, in increments of 10 lb., to 70 lb., a new blade being used each time, and the time of the first cut noted. While the time per cut continued to decrease as the weight increased, the saw in each case was actually cutting at a destructive rate when the weight was increased beyond the amount recommended for that particular blade. Had any of the saws used been tested for the number of cuts per blade and general efficiency, it would have been seen that when the weight rose above 70 lb. in the first cut, the life of the saw was considerably shortened.

While a hack saw must be made to withstand a great amount of abuse, there are limits beyond which it will not go; and where a saw is forced to cut under a greatly excessive weight the gain in time per cut may not offset the loss in saws, spoiled stock, etc. On the other hand, mere endurance without cutting effect, as exemplified in a saw that is worked too "gingerly," does not represent efficiency.

Insufficient Pressure

In a test to determine the results of insufficient pressure, the conditions were exactly opposite to those of the preceding experiment. A weight was applied in each case which was considerably less than that recommended for each particular blade used in the test and the results are shown in Fig. 2. Not only was the time per cut far in excess of what should have been required to cut the class of material on which the test was made, but the life of the saw was decreased almost as rapidly as when too much weight was used. The teeth of the blades were destroyed by slipping and sliding over the work, rather than by cutting.

*Abstracted from "Hack Saws and Their Use," by the L. S. Starret Company, Athol, Mass.

These results make it evident that using too little pressure is almost as inefficient and costly as using too much, while the practice of using insufficient pressure has not even the doubtful advantage of saving time at the expense of the blade and stock, as is the case where too much pressure is employed. Between these two extremes lies the happy mean which represents the acme of hack saw economy.

The actual pressure in lb. per sq. in. of contact area of the tooth, which has been found to give the most satisfactory results as regards both the time per cut and the number of cuts per saw, varies from 20 to 30 lb. It has been determined by careful tests that pressures within these limits, while not overloading the saw, are sufficient to avoid any possibility of the blade slipping and sliding over the work, and thereby becoming dull without having worked to more than a portion of its rated capacity. It has also been found that the basic weight or pressure is directly proportional to the gage of the saw. Standard practice indicates using the 20-lb. unit of pressure for blades not over 0.040 in. thick, and 25 lb. for saws between 0.040 in., 0.060 in. and over.

This so-called unit or basic pressure must not be confused with the weight actually resting on the blade when in use, but must be taken as a constant, by the use of which the actual pressure on the saw may be calculated. The weight, or pressure, is measured by attaching a spring balance to the forward end of the saw-frame, when the blade is in mid-stroke, and lifting. The amount of pull indicated by the needle of the scale is the weight on the blade.

A workman, using a hand frame, almost instinctively bears harder upon the blade as the work progresses and the teeth lose their first keenness. This same principle of gradually increasing the pressure after the first few cuts must be applied to the power saw if efficient work is to result. No matter how nearly correct the weight is at the outset after a certain number of cuts have been made, the pressure must be increased, not only for the sake of reducing the time per cut to a point within the limits of efficiency but also to prolong the life of the saw.

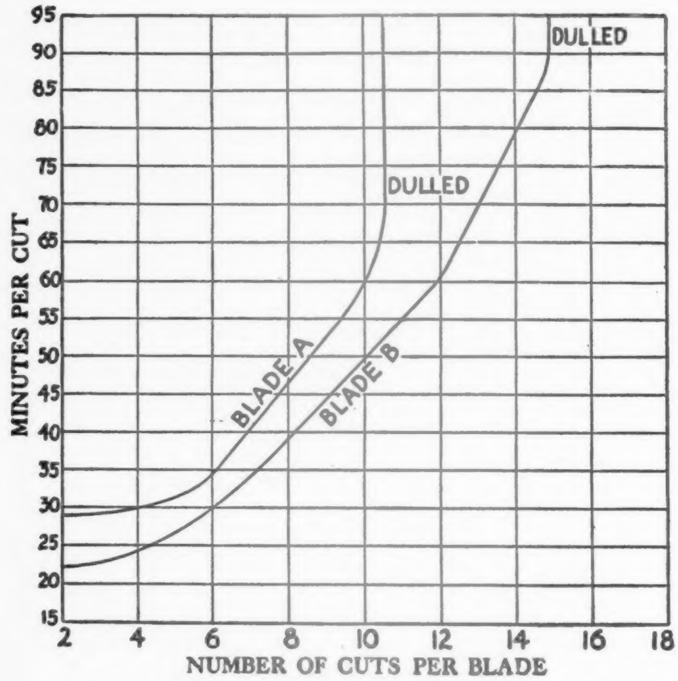


Fig. 2.—Results of Too Little Pressure on Blades

Increase Pressure With Number of Cuts

A saw wears as it is used, and the area of the teeth in contact with the work becomes greater as the number of cuts increase, and therefore, in order to maintain the same cutting speed, the pressure must be increased from time to time. It may be taken as a maxim of hack saw thrift that, for efficiency, the weight must be increased as the number of cuts progresses.

In connection with the necessity for the proper adjustment and increase of weight it is interesting to note that equal diameters of work of the same material will be cut at about the same rate, without regard to their comparative shapes. That is, 1½ in. square, round, or elliptical bars of the same grade of steel would cut at the same rate. Angle irons, channels, and tees of the same greatest dimensions, will cut about alike, provided they are properly placed in the vise. Proper and improper methods of holding different shapes are illustrated in Fig. 3.

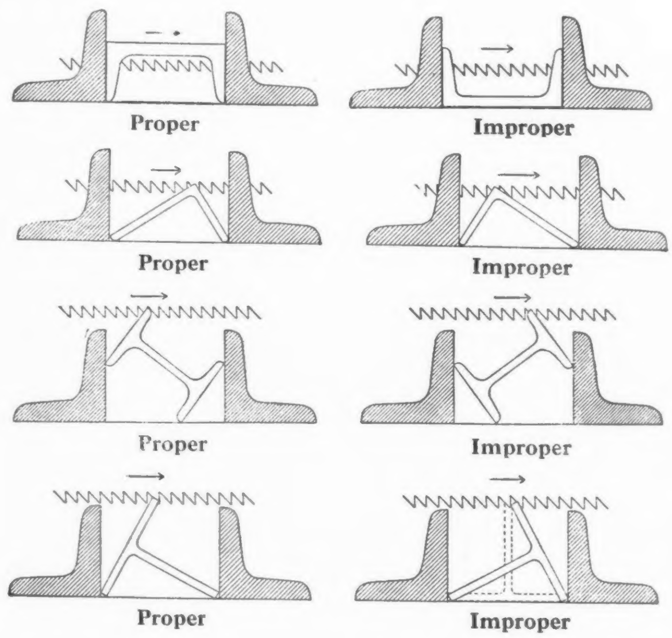


Fig. 3.—Proper and Improper Methods of Holding Various Shapes While Being Cut With a Hack Saw

Cutting speed on rounds of any given material increases as the diameter of the work, and varies in the same proportion as the saw goes through any particular cut. Theoretically, the weight during the progress of each cut should vary directly as the diameter of the work, though this is, of course, impracticable. However, it is essentially practical that, when the time required for any single cut becomes greater than the average time required for cutting that particular class of material, with that particular blade, the weight or pressure on the blade should be increased a few pounds before beginning the next cut.

Increase of pressure to compensate for the wear of the blade is absolutely essential to economy in hack saw work, but it is a factor for which no absolute rule can be given. The most that can be said is, knowing approximately the time in which a certain blade should cut an average specimen of a certain kind and size of material, the weight should be increased by increments from 5 to 10 lb. as often as the time of three successive cuts is above the average. The weight on a heavy gage saw must be increased faster, in proportion to the extra amount of dulled surface or contact area, than for a thinner gage saw, regardless of the difference in weights on the first cut with each. In hack sawing, as in any other form of work, common sense, attention to detail and observations of manufacturers' instructions are great assets.

MICROMETER CALIPERS IN RAILWAY SHOPS

Showing How Output is Improved in Quality and Quantity by the More General Use of Micrometers

BY M. H. WILLIAMS

IN 1324 King Edward II of England decreed by statute that, "Three barley-corns round and dry shall be the definition of an inch." The barley-corn days of measuring are long since out of date not only in commercial but also in railway machine shops where the two-foot rule has ceased to be the standard of measurement. Micrometer calipers, now indispensable in railway tool rooms, are coming into more and more common use for general shop work. It may appear at first glance that the refinements possible with micrometers are not necessary for locomotive and car work, which does not as a general rule require the close fitting demanded in some lines of manufacturing. As a means of quick calipering and securing the required degree of accuracy, however, micrometers are invaluable. A large case of instruments used in a modern railway shop is illustrated in

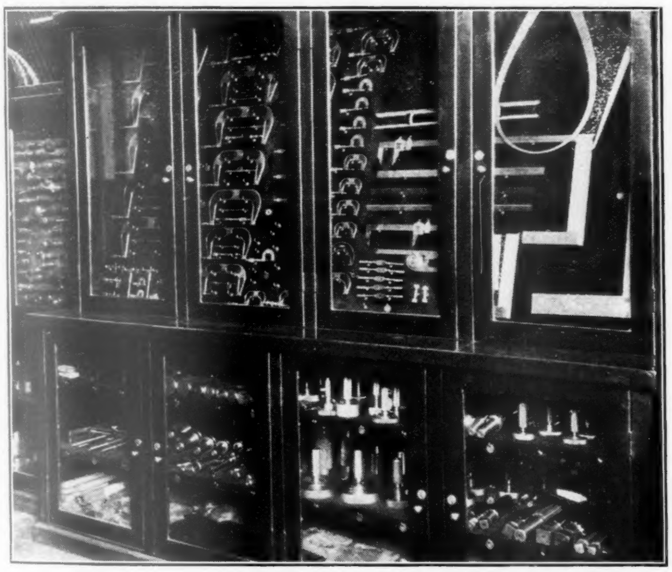


Fig. 1.—Micrometer Calipers Shown in This Case Are Given Out on Checks.

Fig. 1. Common forms of 1-in. outside and adjustable micrometers are shown in Figs. 2 and 3.

Railway shop work being mostly repair work, involves the truing up or re-machining of worn parts and the fitting of new parts. Since it is almost impossible to maintain fixed standards, standard gages can be used only to a limited extent and micrometers will aid in carefully measuring the refinished pieces and new parts with the required degree of accuracy. An accuracy greater than .001 in. is usually unnecessary except possibly for force fits.

Micrometer Sizes Required

Micrometers generally have a range of one inch and different instruments are required for each one-inch range. In order to cover the range of work common to railway shops, it is desirable to provide both outside and inside micrometers for each size up to 12 in. In addition, inside micrometers should be provided for the larger diameters to be measured, such as locomotive cylinders which will require one for each size of cylinder common to the road. For external diameters greater than 12 in., it is advisable to make use of adjustable micrometers having a range equaling the largest piston usually handled. The cost of the instruments mentioned, without duplicates, is about $300. For certain of the more frequently used sizes, it is necessary to provide duplicates that will add to the cost, but the reduced number of spoiled or misfit parts will more than offset the additional expense. Experience in practically all shops where micrometers have been used indicates that workmen will exercise the same care in handling them as a scale or any finished tool and that the cost of upkeep is not a serious consideration. The instru-

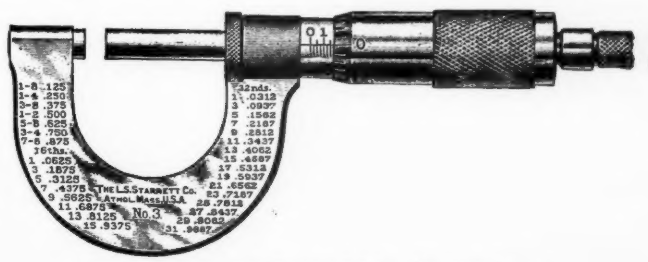


Fig. 2.—Common Type of 1-in. Micrometers.

ments are generally a part of the tool room equipment and given out to any man who may have use for them on tool checks, the same as twist drills, taps, reamers, etc. It is good practice to check each instrument to a standard measuring rod when returned.

Shopmen accustomed to machinists' calipers learn to caliper with micrometers in a few days. Regarding errors in readings, it may be well to consider a concrete example. If it is considered satisfactory to continue piston rods in service where the difference in diameter at any two points does not

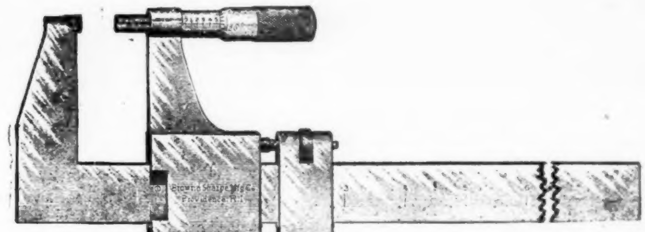


Fig. 3.—Adjustable Micrometer Calipers.

exceed .001 in., measurements with micrometers will show at once if the rod is within these limits and settle definitely the question of repairs. This measurement, also, will tell if the rod is worn to an unsafe limit. The same measurement made with machinists' calipers takes longer and does not give as certain results. Machinists' calipers must be set for each diameter measured, the same as with micrometers, and in each case be compared with a scale or rule in order to determine the differences. Close measurements such as the .001 in. limit in piston rod diameter are impossible to measure with machinists' calipers. Another consideration is the greater ease in reading micrometers.

Axle and Crank Pin Calipering

Axles and crank pins can best be fitted by the use of micrometers. The wheel bores are not exactly to drawing

size owing to wear and other causes and the corresponding parts must be fitted accurately to insure safety. Each .001 in. difference in diameter between a car axle and steel wheel bore varies the mounting pressure from 5 to 10 tons. As an example, assume that similar steel wheels are bored exactly 7 in. One axle, turned to 7.007 in. diameter, will mount at about 70 tons pressure, and another axle, turned to 7.008 in. in diameter, will mount at 5 to 10 tons higher. Wheels and axles are fitted correctly in everyday practice when measured with machinists' calipers and nothing is to be said against the good work that is being done. This close measuring can be done more accurately and quickly, however, by the use of micrometers and the number of misfits will be reduced. The operation of calipering an axle fit in a wheel center is shown in Fig. 4.

In order that the axle and crank pin may be a secure fit in the wheel center, a uniform bearing from end to end is necessary. Likewise, the wheel center should be bored a uniform diameter its entire length. Unless the machines are in an excellent state of repair and the work well done, there are possibilities of the parts being tapered, which is difficult to measure correctly with machinists' calipers. This bad practice may go on for some time if not detected with micrometers and remedied.

Side Rod Brasses

Boring side rod brasses to suitable sizes for running fits on worn crank pins in locomotive repair work is also adaptable

Fig. 4.—Calipering the Bore of a Wheel Center.

to the use of micrometers. It is necessary to measure each pin accurately and bore each brass a definite amount larger than the pin, subject to a reasonable machining tolerance. As an example, suppose good practice indicates that the bore of the brass for pins 5 in. to 6 in. diameter should be not less than .010 in. or more than .015 in. larger than the pin, in order not to cause heating by reason of too tight a fit, or too much lost motion on account of too loose a fit. If the crank pin is exactly 6 in. the brass would be bored between 6.010 in. and 6.015 in. The next crank pin may have more wear and only measure 5.970 in., in which event the brass would be bored between 5.980 in. and 5.985. All the refinements possible with solid limit gages may be obtained with micrometers and any set degree of tolerance quickly measured. For force fits of brasses in rods an allowance of .002 in. to .003 in. is usually made, and this can always be best measured by micrometers.

Crank pins can be measured more quickly with micrometers than with calipers and scale and the sizes set down on a memorandum or form. The operation of measuring new pins is shown in Fig. 5. When boring rod brasses, the inside micrometers can be set quickly and the bore measured with sufficient refinement to insure its coming within required tolerances.

The use of micrometers makes it possible for a designated person to measure all crank pins and similar parts. Where this method is followed memorandums made of the measurements may be given to the various machine operators who will not be called on to leave their machines to go to distant parts of the shop for the purpose of measuring locomotive parts too bulky to take to the machines. This will result in less idle time of machines.

Crank pins are generally found to be worn out of round and tapered when the locomotive comes to shop for repairs.

Fig. 5.—Crank Pins Are Calipered and the Dimensions Filled in on a Form.

The amount out of round or taper should be ascertained in order to judge as to the necessity of re-finishing or renewal. By measuring the pins at the necessary points with micrometers the exact amount of wear will be at once detected. Where a limit has been set governing this wear the question of passing or repairing will be at once settled.

Cylinders

For the purpose of measuring the bore of cylinders, inside micrometers as shown in Fig. 6 are used. They have a range

Fig. 6.—Checking the Amount of Cylinder Wear.

of only one inch, which makes it necessary to provide one for each one-inch range in order to measure cylinders handled by any shop. Inside micrometers are also made with an extension piece, by which a considerable range of sizes may be measured with one instrument. This reduces the number of

calipers required, but also introduces chances for error on account of improper setting of the extension piece. The bore of cylinders when new should be measured to ascertain if they are reasonably close to drawing size, as it is a question whether locomotive cylinders can be bored commercially to exact micrometer sizes. However, they may without too great refinement be bored to a limit of 1/64 in. or .016 in. Measurements made with micrometers of the bore at each end will at once check this dimension, and should there be too much of an error steps may be taken to remedy the defects.

When locomotives are repaired the cylinders should be measured in order to determine the wear, or the amount the walls are worn hollow resulting from the travel of the piston head or other causes. On some roads a limit has been set governing this amount, that may be ⅛ in., 3/16 in., etc., depending on conditions. When measured with micrometers, the readings will at once show the amount of variation there may be between different parts of the cylinder and will indicate if reboring is necessary. When turning piston heads, the memorandum taken of the cylinder bores may be made use of by deducting the amount the piston head should be smaller than the cylinder bore.

The disadvantage in measuring cylinders with machinists' calipers is the possibility of error owing to their adjustment being changed while carrying, and also errors due to setting

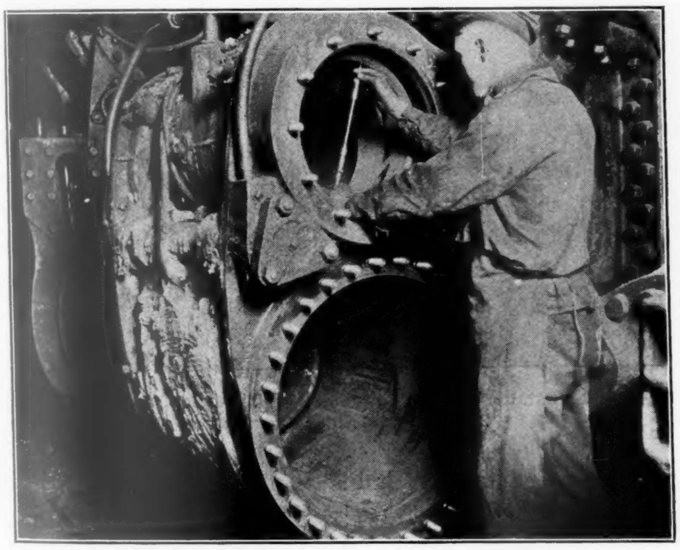


Fig. 7.—Calipering a Valve Chamber Bushing.

one caliper to another. It would be difficult if not impossible to establish limits of variation from the required sizes for turning the piston head on account of the difficulty of reading machinists' calipers closely.

In measuring piston rods and valve rods a few points about the diameters should be considered. Both rods should be of uniform diameter where passing under the rod packing, and unless this is the case, rapid wear of the packing will result. These parts need not be machined to exact diameters, but they should be as close to one size from end to end as possible. By the use of micrometers the rods may be measured at various places and a limit of .004 in. or .005 in. maintained. Where rod diameters are checked with micrometers a decided improvement will be noticed in the reduction of steam leaks.

Piston Valves and Bushings

In order to obtain proper working piston valves it is necessary to make the valve of the correct size in reference to the bore of the bushing into which it works; also, the bushings must be of the right size in order to obtain the desired results. Most valve chambers will be found out of round in the bore for the bushings resulting from the heat of the steam and natural distortion of the casting. By measuring the bore horizontally and 1/3 the way around from the horizontal with inside micrometers, and taking the average of these readings, the average diameter of the cylinder bore is obtained. This size plus the amount the bushing should be larger to allow for a force fit in the cylinder will be the diameter that the bushing should be turned.

Valve bushings are bored larger than the average diameter of the valve chamber bore an amount which will vary with the different diameters of bushings and thickness of walls and may be .005 in. or .007 in. When micrometers are used, experience will soon indicate the exact amount that this should be and bushings may be turned of correct size to insure a proper force fit in the cylinders, avoiding the possibility of steam leaks. When measuring the bore of new bushings or determining the exact amount of wear, inside micrometers may be used as shown in Fig. 7. The diameter of the piston valve bull rings may be measured by a method similar to that explained with reference to piston heads.

Driving Axles and Journals

The journals of driving axles are usually found to be worn out of round, tapered, or both. A slight variation from a perfectly round and uniform diameter does not necessarily call for refinishing; but there is a point between the slightly worn and the excessively irregular axle where refinishing becomes a necessity. This is in some shops governed by a set limit of 1/32 in. or, for easy figuring, .030 in. Measuring the journal with micrometers makes it easy to determine if the limits have been exceeded. As an illustration—if a journal measures 9.860 in. at one place and 9.880 in. at another, showing a difference of .020 in., refinishing would not be considered necessary. Should the readings be 9.870 in. and 9.910 in., making a difference of .040 in., the journal must be refinished.

In the case of a journal having a difference in diameter of only .020 in., a record may be made of the size and made use of when boring the driving box; likewise, the sizes of the journals may be measured after returning for the same purpose. Accurate measuring of the journals after refinishing is in many respects quite important on account of the possibility of their not being regular in size owing to the heavy counterweight on the wheels throwing the lathe out of balance. Improper setting of tool posts also often results in tapered journals. In actual practice micrometers will be found of the greatest value on this work by showing up bad workmanship and lathes not in the proper state of repair or setting.

Driving Boxes

The crown brass of a driving box is somewhat difficult to caliper on account of not being a full half circle, and as a result ordinary calipers cannot be used. In order to overcome this difficulty special three-pronged calipers, as explained in the *Railway Mechanical Engineer* of March, 1919, have been devised. These calipers are illustrated in Fig. 8. Without going into the description too minutely, it may be said that the three prongs, H, H_1 and H_2 are forced outwards by the descent of the taper plunger G, that in turn is controlled by the micrometer head E, the diameter being indicated by the readings on the micrometer dial similar to the method of reading any instrument of this nature. The various springs and appliances shown are for the purpose of taking up lost motion and making the caliper workable.

In practice, journal diameters are measured and sizes recorded on blanks or memorandums, as already explained. The amount the crown brass should be larger than the axle is added to these sizes and the box bored accordingly. During the boring and after its completion the exact bore of the brass is measured with the special calipers shown.

The advantages of this plan as compared with older methods are principally that the diameter of the axle and

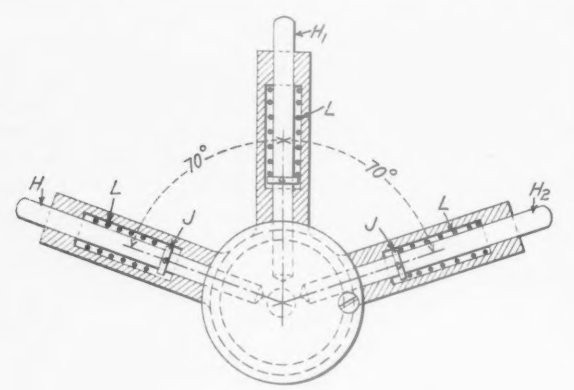
driving box may be closely measured and the shell made a definite amount larger than the axle. Where this amount has been carefully worked out and checked, the work of scraping a box to fit the axle may be eliminated, which will result in quite a saving in labor. The three-prong calipers are also useful for checking the accuracy of the rams of boring mills used for boring boxes. These rams are liable to be set out of perpendicular with the mill table and bore larger at one end. A measurement made at both sides of the box will indicate whether the ram is properly set.

Car Wheels and Axles

Micrometers are now used quite extensively for the purpose of measuring the sizes of car axles after being turned. In order that the wheel shall be a safe and satisfactory force fit on the axle the wheel seats should be of a uniform diameter throughout, as in the case of driving wheels. With the more numerous repaired axles it is the general practice to re-turn them to the largest diameter to which they will true up, and as a result each wheel seat is of a different diameter. Measuring by micrometers will be found quicker and more accurate than any other method.

If the difference in diameter from end to end of the wheel seat for steel wheels is kept within .003 in. and for cast iron wheels .005 in., good results will be obtained. For the purpose of checking these sizes the wheel seats should be measured at ends and in the middle, and the sizes recorded on a memorandum for use when boring the wheels. For steel wheels, the axle should be about .001 in. larger than the bore for each one inch of diameter. That is, for a 7-in. wheel bore, the axle should be about 7.007 in. in diameter. Cast iron wheels would require about double this amount. Inside micrometers are made use of for measuring the bore sizes in order to insure their being correct; also to ascertain if the bore is of one diameter from end to end. This operation will detect any taper and prove the correctness of the size in reference to the axle diameter. An error in turning or boring could not be accurately measured with machinists' calipers Boring bars having micrometer dials are now largely used for wheel boring and, where wheel seats are measured with micrometers, the sizes for setting the dials on the bar will be at once indicated. As a result, the bar may be quickly and accurately set for as many different sizes as may be required in practice.

The uses for micrometer calipers that have been mentioned can only be considered as representative cases. Where these are once introduced into a shop their use will spread to practically all machining operations where reasonably accurate measurements are required. On account of the ease with which measurements may be made and the accuracy readily obtainable the average workman will prefer these to machinists' calipers, and, when once introduced, there will be difficulty in getting the men to use other forms of measuring devices.



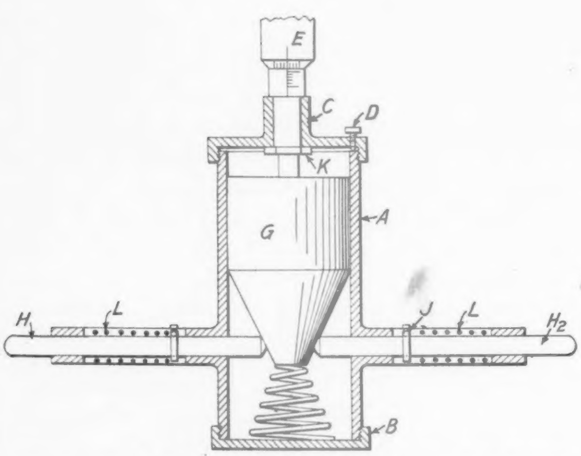


Fig. 8.—Three-Pronged Micrometers for Driving Boxes.

Fig. 9.—Adjustable Outside Micrometers Must Be Used With More Care Than Solid Instruments.

Blind Workers in Cleveland Shops.—Sixty-nine manufacturing operations, principally in the metal-working industries, are now performed successfully by blind workers in Cleveland, according to an article in the *Iron Age*. This city was among the first in the country to see the possibilities in industry for blind artisans, and a start was made in February, 1913, when the Society for the Blind placed one man with the Lake Erie Bolt & Nut Company. He did hand nutting and his pay ranged from 80 cents to $1.25 a day. The movement progressed slowly until war-time conditions created a shortage of labor and since then many openings have been secured. Today there are 81 blind men and women working in 40 different factories. Some of the operations performed include assembling parts, nutting bolts by hand and machine, operating machine tools, packing and sorting. The electrical field has so far revealed more practicable operations than any other, but machine operations have been proved feasible for blind workmen.

THE MANUFACTURE OF SEAMLESS STEEL TUBING*

An Outline of the Method Used in Making Shelby Seamless Steel Tubing from Solid Blooms or Billets

SO many seamless steel tubes and flues are used in repairing and maintaining locomotive boilers and for various mechanical purposes that it is believed the following brief description of the modern methods of making seamless tubes will be of general interest to railway shop men. Satisfactory tubes cannot be made without uniform steel of good quality. This steel is delivered to the heating furnace in blooms of several sizes and weights, 6 to 10 in. square by 11 ft. long and weighing 1,300 to 3,750 lb. After the blooms have been carefully inspected for surface defects, and any irregularities chipped off with pneumatic chisels, they are conveyed by a crane to a furnace room where an electrically operated charging mechanism picks them up one by one and places them in a heating furnace.

Fig. 1.—Square Billet Entering Bar Mill

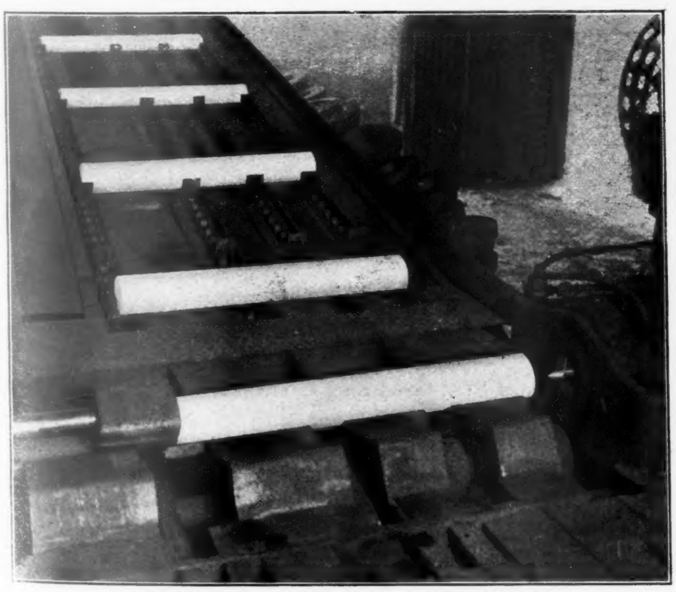


Fig. 2.—Pneumatic Centering Machine in Operation

When the proper temperature for rolling has been reached, the bloom is pulled from the furnace by the long arm of a crane or transfer mechanism and placed upon a small electric buggy; this buggy transfers it to the rolling table of the bar mill (Fig. 1) where it passes through a series of rolls which changes the square bloom into a round bar of smaller size and greater length. Different sizes of round bars are thus rolled according to the size of tubes required to be made from them. Some of the bars are 8 in. in diameter when finished, while others are as small as 3 in. While still at rolling heat, the round bars are cut to different weights (according to the length and wall thickness of the finished tube) by a circular saw, and centered while still hot (Fig 2). They are then allowed to become cold, afterwards being inspected, marked with a die to identify the steel, and sent to the piercing mill.

The bars are now known as billets, or "rounds," and contain just enough metal for making tubes of the desired length, thickness and diameter, and to compensate for normal losses incident to the manufacture of the tube. After the billets have been centered, inspected and marked, they are placed in a heating furnace of special construction. The bottom of the furnace is inclined, and centered billets of the proper length are fed into the upper and cooler end, from which they roll by gravity to the lower end, where the temperature is high enough to render the steel soft and semiplastic.

Fig. 3.—Heated Billet Entering Piercing Mill

The piercing mill (Fig. 3) is located close to the discharging end of this furnace and the billets are fed into it, centered end foremost. The solid billet, almost white hot, is pushed forward until it is caught by the revolving rolls of the piercing machine which force it over the piercing point of a mandrel. As the billet is forced over this bullet-shaped point by the combined forwarding and rotating action of the heavy revolving rolls (Fig. 4) a dull, grinding sound

*Extracted from a booklet entitled "Shelby Seamless Steel Tubes and Their Making," by the National Tube Company, Pittsburgh, Pa.

is audible. While enormous force is required to operate the piercing machines, there is nothing spectacular about the operation, nor much suggestion of the power required to displace the metal from the center of the hot billet toward the outside. So powerful are the revolving rolls of the piercing machine and so carefully planned is each part of the massive machinery, that the billet is transformed into a tube with apparent ease.

The newly pierced billet is simply a rather rough, thick-walled, seamless tube. It is raw in appearance and not particularly true to size and retains the knurl marks of the piercing rolls on its battered surface. There is positively no weld or seam, however, the round bar of steel having been

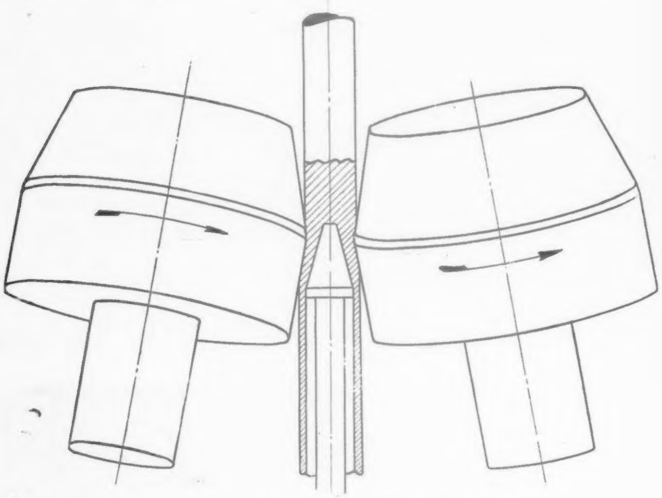


Fig. 4.—Diagram of Piercing Operation

pierced quite through its length, as a potter would force a pointed rod through a cylindrical mass of moist clay. Because of the thickness of its walls, the pierced billet is short and to change this thickness into length is the next requirement. Accordingly, it is rolled through adjustable rolls and over a mandrel held in the roll groove by a long

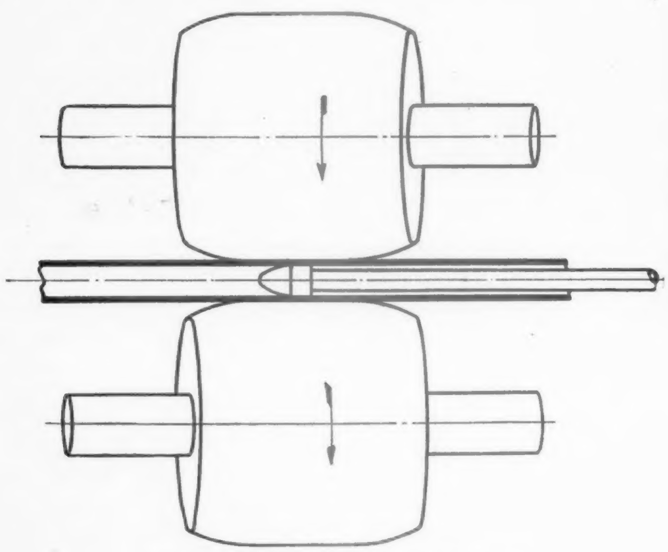


Fig. 5.—Diagram of Reeling Operation

steel bar, where the wall thickness and diameter are reduced. In this manner the pierced billet is converted into a longer tube with walls of uniform thickness having a fairly smooth finish.

While still at suitable working temperature, the rolled tube passes on through the reeling machine. This is another form of rolling machine, consisting of two heavy rolls of special design (Fig. 5), set with axes askew, which may be adjusted to a thousandth of an inch. As the tubes are fed through these rolls any mill-scale is removed and they are given a smooth, burnished surface, the outside diameter of the tube being corrected to some extent.

From the reeling machine, the tubes pass to the sizing or

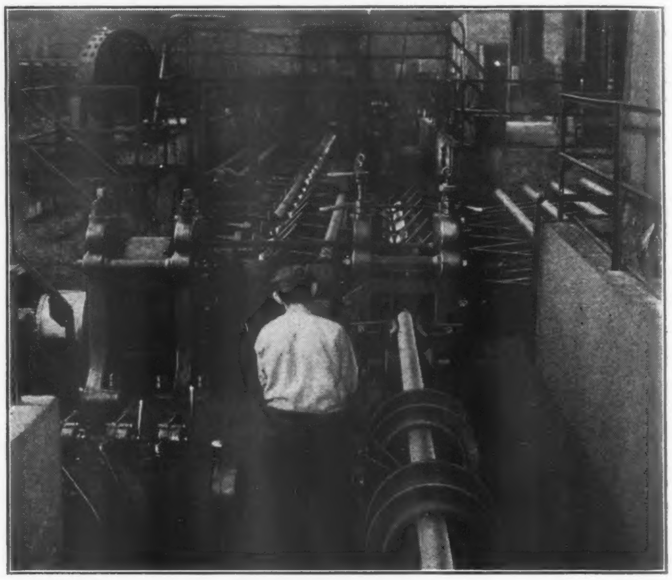


Fig. 6.—Reheated Tubes in Sizing Roll

finishing rolls (Fig. 6) which give the exact outside diameter required. From the finishing rolls, the tubes travel to an inclined cooling table (Fig. 7) up which they slowly roll, and after being sorted and inspected are dropped into racks, ready for removal by electric cranes. The electric cranes transfer the hot finished tubes to cutting-off machines where the rough

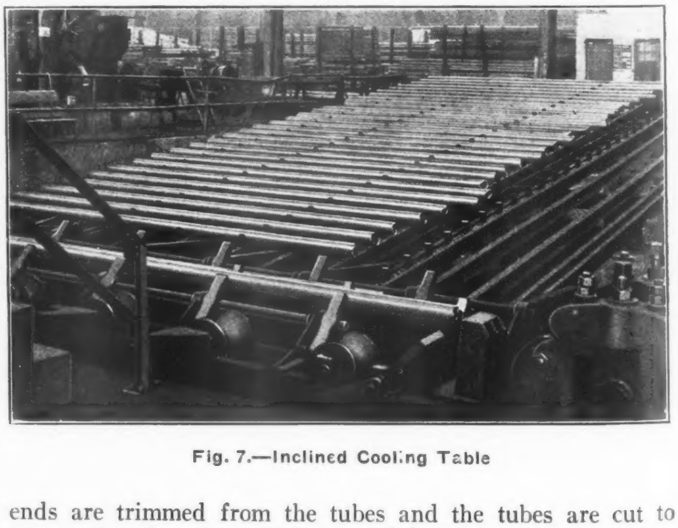


Fig. 7.—Inclined Cooling Table

ends are trimmed from the tubes and the tubes are cut to proper length. Any slight straightening necessary is then done, the tubes thoroughly inspected (if boiler tubes, a hydrostatic pressure test is also applied), then stencilled, put in stock or sent to the shipping room.

THE ENGINEERS' COMMITTEE of the Fuel Administration issued a report which contained figures showing the effect of lack of cars on the cost of mining coal. This information is being circulated in a diagram published by the National Coal Association and is reproduced in some of the leading coal trade journals.

Master Blacksmiths Meet at Detroit

The Subjects Most Thoroughly Discussed Were Frame Repairing, Spring Making and Reclamation

OVER one hundred members of the International Railroad Master Blacksmiths' Association were in attendance at the twenty-sixth annual convention which was held at the Hotel Statler, Detroit, Mich., August 17, 18 and 19. Following the customary opening exercises the president's address was delivered by John Carruthers (D. M. & N.).

President Carruthers' Address

In opening his address President Carruthers referred to the fact that at the last convention, Birmingham, Ala., was chosen by ballot as the place for this year's meeting and explained to the members that inability to secure suitable hotel accommodations made it necessary to seek another meeting place. Detroit was chosen because, next to Birmingham, it had received the largest number of votes.

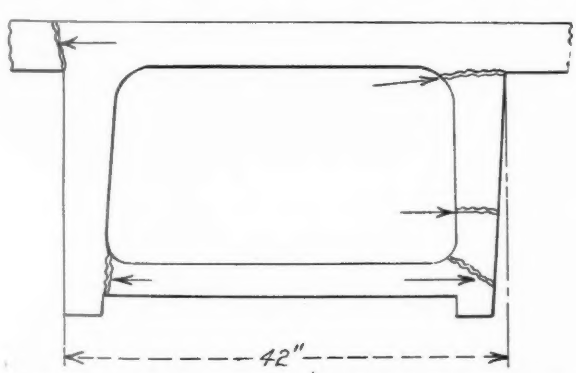
Speaking of the importance of the work of the Association, President Carruthers said in part: "Never before in the history of railroading have we felt so much in need of the newest and most improved methods to obtain better service and the greatest possible production. Let us have the co-operation of all the members to the end that the largest measure of good may be brought out of our deliberation both for ourselves as individuals and the companies we represent. It is up to the supervisory forces to untangle the mesh in which the railroads have been returned to their owners.

FRAME MAKING AND REPAIRING

By F. F. HOEFFLE
Louisville & Nashville

Wrought iron for new frames has been displaced by steel and the steel frame has been developed to better design and efficiency. But the modern well-designed frame breaks and failures often take place at strong sections where least expected. Our problem is, therefore, the repairing of frames.

The Thermit weld has brought about wonderful results in keeping power in service, yet there are conditions brought about by the Thermit weld which have not been overcome, such as holding in abeyance expansion and contraction. Where numerous Thermit welds have been made on frames in roundhouses and the welds are very close together, one is led to believe that these numerous welds were caused by not holding expansion and contraction in submission.



Welds of Frame Members Which Are Bound Together, thus Preventing Freedom of Expansion and Construction

When a Thermit weld is made on a frame at a point where two or three members are bound together, the expansion and contraction cannot take place freely; hence the weld is liable to cause a strained condition at another point. Such portions of frames are seen with a number of welds, no matter how carefully preparations were made to overcome this faulty condition. A weld which is capable of adjusting itself with no danger of causing a stress at another point has proven to be a good proposition.

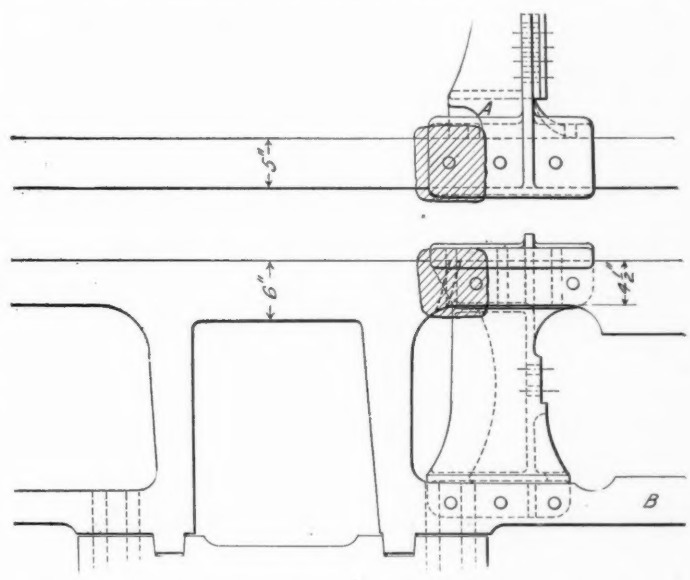
When an engine is brought into the South Louisville shops of the Louisville & Nashville for a general overhauling and it is necessary for the boiler to be dismantled, if the frames are in bad condition they are turned over to the smithing department and at once the entire set of frames is placed in a soaking pit and heated thoroughly, then allowed to cool. They are then brought into the blacksmith shop, all Thermit welds removed and the frames put in first class condition.

This practice has given the results we looked for, and is evidence that the anvil is the proper place to repair a frame.

The oxy-acetylene process is used to great advantage for such work as cutting and the filling of surface defects; but where a frame is broken its use is not considered a good proposition.

By G. W. KELLEY
Central Railroad of New Jersey

The successful use of the electric, oxy-acetylene and Thermit process for welding depends largely on the operator, who must be an enthusiast and must be trained as an apprentice before he can become an expert and successful operator.



Charcoal Was Used to Heat the Upper and Lower Frame Rails for Expansion in Making This Thermit Weld

The use of these different methods of welding has produced wonderful results. However, in their experimental period, failures were made by many who did not understand the nature of the various metals, or did not allow for the proper expansion to take care of the contraction. The sketch will illustrate how much expansion is sometimes necessary where it has required 115 lb. or more of Thermit to make an engine frame weld.

The cast steel cross brace was cut out at *A* to permit the wax collar and mould to be applied. This was also necessary to allow the top rail of the frame to expand. We used three charcoal containers to get expansion: one on the lower

frame rail at *B* and the other two at the opposite sides of the weld. While the mould was drying and preheating the expansion was also taking place. When the proper expansion was obtained, which was 9/32 in., the weld was made. When the frame was cold the tram was perfect. The cross brace was then electric welded by the metallic electrode process. We prefer charcoal to an oil burner for obtaining expansion because with the oil burner the contraction in the frame takes place much faster than in the weld. When the weld is made we let the charcoal remain in the metal containers and all frame members contract together. No more attention is required until the frame is cold, as we arrange to make the weld at the last working hours of the day.

Discussion

The discussion of this subject was confined practically to the application of the various welding processes and a variety of methods which have been used successfully with each process were brought out. The discussion indicated that at least among those taking part in it the Thermit process is still most generally used in welding complete fractures of frame members. In some cases this process has been adopted to the exclusion of the others except for building up worn surfaces. It was evident, however, that both the gas and electric welding processes are being used for heavy frame welding with complete success. The electric welding process is meeting with favor for this work because of the small amount of contraction which must be allowed for, thus simplifying the preparation for the welds. One of the members stated that with no allowance for contraction whatever where the electric process was used the effect of contraction would be no greater than with Thermit, oil or gas welds where the most careful preparation had been made. Excellent results have been obtained with the gas welding process employing the usual run of operators obtainable under the national agreement. Several members, however, dwelt on the necessity of more care in the training of operators if the electric and gas welding processes were to continue to advance. The practice of requiring welders to turn in test welds periodically, to be pulled in the test machine, is being followed by some master blacksmiths with excellent results. The welders are rated according to the strength of the welds relative to the strength of the unwelded material.

The national agreement, in making welding a preferred job in each craft, has tended to destroy permanency of employment on these jobs. The men consider the work temporary, often leaving it to return to the regular work of their trades before they have been at it long enough to become thoroughly skilled operators and the company suffers in consequence.

SPRING MAKING AND REPAIRS

By J. W. RILEY
Lehigh Valley

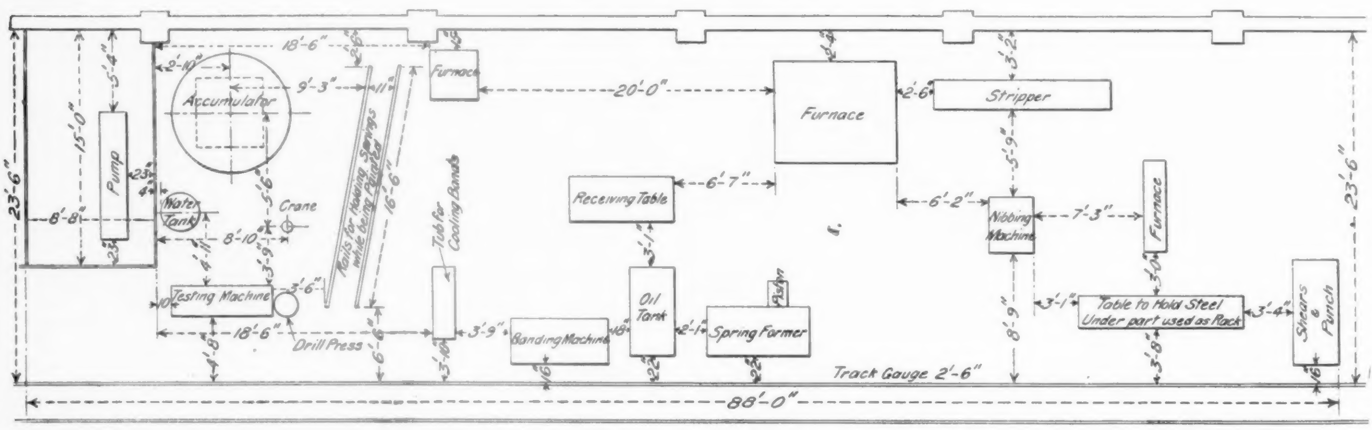
In 1915 the management suggested that we submit a list of machinery that would be required for making and repairing of springs for the Lehigh Valley System. After going over the advantages of such a plant a decision was finally reached in favor of purchasing the machinery. The following is a list of machinery installed in the smith shop, occupying a floor space of 88 ft. by 22 ft. The arrangement, which is shown in the drawing, is very convenient.

Machines Installed in Lehigh Valley Spring Plant:

- Hydraulic steam pump.
- Hydraulic accumulator.
- Combination punch and shears.
- Combination nibber and trimmer.
- Hydraulic band stripper.
- Hydraulic bander with assembling table.
- Universal elliptic spring former.
- Oil tank with water jacket.
- Single fitting or forming furnace.
- Furnace for nibber and punch.
- Banding furnace.
- Thirty-five ton testing machine.
- Small air drill for drilling bands.

Before starting in the spring work I visited a number of spring plants and in most places found that they were equipped with rolls for forming. These were not much in use, however, and the springs were being formed by tongs and hand hammers. This method is slow, is hard work for the spring maker and only an expert can do a good job. The tongs and hammer do not set the plates so they have a full surface bearing, strains are set up in spots, causing the leaves to warp when cooled in the oil, and it is necessary to overheat heavy plates to be able to form them. Over-heating the steel is one of the greatest causes of broken springs. Another effect of over-heating is the reduction in the weight of the steel. A spring heated and formed about twenty-five times will be reduced about one leaf on a twenty-five leaf spring; the higher the temperature the greater is the reduction.

As a result I developed a universal elliptic spring former, which performed the work so successfully that the former was placed on the market and is now in use in several spring plants. With this the leaves are scientifically formed and any twist that may be in the steel is taken out. It is universal because it is ready at all times to receive leaves of any radius, length, width or thickness. With this machine the fitter requires no assistance from the heater, who may devote his entire time to heating and passing out the leaves. There is no need of heating the steel over 1,500 deg., F., as the machine will properly set the leaves at that temperature and it takes but an instant from the furnace to the oil. A master plate is used in setting the main plate and the balance of the



Layout of the Lehigh Valley Spring Shops

spring leaves are formed by pressing the hot leaf against the cold leaf. One stroke of the machine forms the leaf and gives it the desired amount of snap.

We do not taper the leaves. They are left square on the ends as they come from the shears. We use loose gib plates; some are cast steel, while others are formed in dies and made from scrap steel.

When we started repairing purchased springs we had eight men working 10 hours and a lot of overtime. After running a large percentage of the springs through the former the work kept decreasing until in a year's time we only required six men. Six months later only four men were working 10 hours and at present we have four men working 9 hours. These men do all the making and repairing for the Lehigh Valley System. The equipment consists of 1,000 locomotives, the tenders of which have elliptic truck springs, 700 coaches and 475 cabooses which have elliptic springs. These four men do not make bands. The bands are made in the forging machines and at the forge.

The records of one shop that had been using the tongs for fitting show an average of 36 trailer truck springs repaired per month. After the former was installed and a number of these springs run through the former the repairs to these trailer springs was reduced to six per month.

We use the flash temper. After using this method of tempering for four years I do not want to change to any other.

Discussion

The discussion centered around the practicability of making and repairing springs in railroad shops. The opinions expressed on this subject were generally in favor of this practice rather than purchasing manufactured springs and having them maintained either by the manufacturer or in the railroad shop. Where this practice has been adopted the results obtained have been substantially the same as those indicated by Mr. Riley in his paper.

The practice on most of the railroads whose representatives took part in the discussion is to repair springs on store department orders, replacement being made from store stock instead of directly from the blacksmith shop. The hammer test is generally depended on in large shops to detect broken leaves. This is applied either directly in the erecting shop or in a blacksmith shop. In some cases all springs are removed to the blacksmith shop, where those which pass the hammer test are placed under the spring testing machine to determine the load capacity before being passed as suitable for further service.

One case was mentioned where considerable trouble had been experienced from repeated failures of the short leaves on a class of heavy trailer springs weighing 875 lb. each. The failures in these leaves occurred at the edges of the band. It was finally decided that the trouble was due to the broad bearing of the band against these leaves, which destroyed their flexibility and caused a concentration of load at the edges of the band. The trouble was overcome by rounding off the edges of the upper surface of the bottom side of the band, thus producing a crown bearing for the short leaves, which permitted them to deflect throughout their length.

RECLAIMING SCRAP MATERIAL

By F. B. NIELSEN
Oregon Short Line

In railroad shops of considerable size, in order to obtain best results in reclaiming scrap material, one of the first steps to be taken is the formation of a scrap committee. This committee should consist of representatives of the following departments: motive power, car, bridge and building, maintenance of way, and store department, accompanied by others qualified to pass judgment on the serviceable and scrap material. This committee should report to the superintendent of motive power at least once every week.

A committee of this kind has been established at the main shops of the Oregon Short Line at Pocatello, Idaho. It is composed of the superintendent of shops, engineer of the maintenance of way department, general foreman of the store department, general foreman of the car department and one or two foremen from the various departments who are invited to accompany the committee each week. This committee visits the scrap dock, taking out any serviceable material that may be used. Each case is taken up as an item on the minutes and given a number. A copy of the minutes of the meeting each week is sent to the head of each department and those responsible in each department are required to make a report to the chairman of the committee, as to why this material was scrapped.

A general inspection of the yards is made once each month, taking in all buildings, to see what material is lying around that is not being used. This is also reported.

This committee has proved very successful in reducing the amount of serviceable material found in the scrap pile and cases where such material is scrapped are constantly becoming more infrequent.

On the Oregon Short Line we have a re-rolling mill, and reclaim practically all small size iron, from ½-in. to 1¼-in. round, and from ⅜-in. by 1½-in. to ¾-in. by 2¼-in. All washers are made from scrap sheets and plates accumulated at the scrap dock. About seventy per cent of all scrap spikes

J. CARRUTHERS (D. M. & N.)
President

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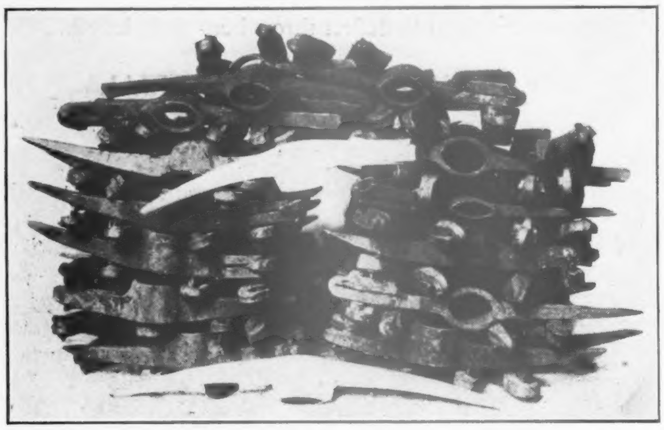
First Vice-President

J. GRINE (N. Y. C.)
Second Vice-President

A. L. WOOLWORTH (B. & O.)
Secretary-Treasurer

are reclaimed. These spikes are straightened in an air-operated machine constructed especially for this purpose. After being straightened they are put in a rattler to be polished. All second-hand bolts are reclaimed by cutting off and re-threading.

I have observed, from the different material removed from foreign line equipment that is coming into the welding room



Worn Picks Prepared for Reclamation by Welding on Stock Drawn Out from Scrap Mauls

of our shop, that proper attention is not given to oxy-acetylene welding.

Our practice is to give each welder a piece of steel 1½ in. square and 14 in. long all from the same bar. This piece is cut in the center, welded and then broken in a tensile testing machine. When we first began these tests the lowest record of tensile strength was 67 per cent of the original strength and the highest 83.8 per cent of the original strength, with a reduction of area of 8 per cent and practically no elongation. The last test made in April, 1920, by the same welders and the same method showed the lowest record of tensile strength to be 85.7 per cent and the highest 99.7 per cent of the original test, with an elongation of 6.5 per cent.

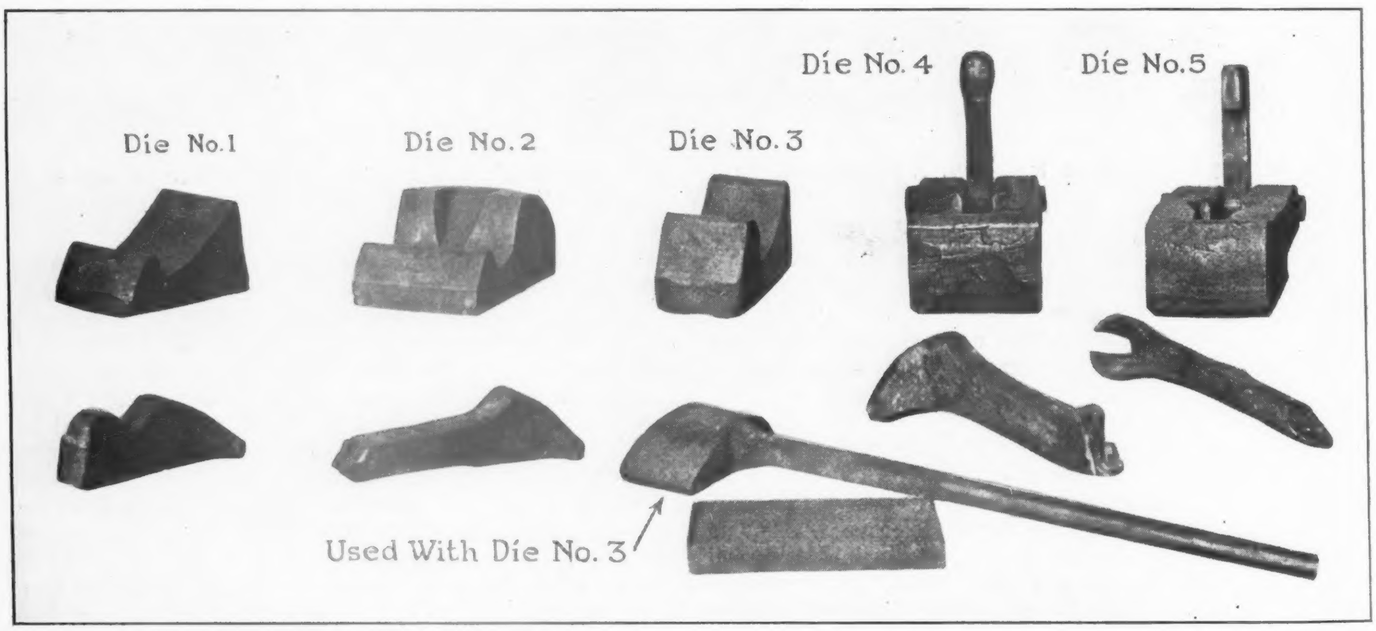
Through information obtained by this method the best welders are selected for reclaiming such material as couplers, frame work, and other work requiring a high percentage of efficiency. I feel sure that if this method were followed there would be no objection by the American Railroad Association to the reclamation of some of the material to which they now object.

Frogs and switch points are reclaimed and fair success has been attained in reclaiming manganese steel frogs and switch points. All track tools on the system are sent to Pocatello for repairs. When picks become too short we draw out some of the scrap spike mauls, which are then welded into the picks, making them of standard lengths. Claw bars are reclaimed by forging out the claw end from scrap tire steel and welding to the old bar. One of the illustrations shows the steam hammer dies employed in forming the claw ends.

Coil springs that are standard are reset and scrap springs are made into drift pins, small lining bars, jack bars, etc. The tamping and the spade ends of tamping bars are made from scrap coil springs. These are welded to the old bar. Scrap tire steel is drawn out for track lining bars, pinch bars, piston keys, spring hanger gibs, coal picks and similar pieces.

We have recently received a number of hollow heat treated locomotive axles. When obsolete they are reclaimed for making guides, counterbalance sheets, follower plates, dry pipe rings and dies for forging machines. We also reclaim piston heads with Tobin bronze. Main rods that are worn from lack of oil are also reclaimed with the same process.

Lathe tools for wheel lathes are drawn out of scrap tire steel and high speed steel is welded on by the oxy-acetylene process. Many shops do not seem to have good results in reclaiming these tools, and I do not think it is practical to make small tools by this process. Another important thing in the reclaiming of all material sometimes overlooked in the cutting and dressing of high speed tools, is that all pieces cut off and all broken small tools, such as drills, reamers, etc., should be saved and turned over to the store department for reclaiming.



Steam Hammer Dies for Forming Claw Bar Ends. Die No. 1 Draws the End and Forms the Heel; Die No. 2 Shapes the End; Die No. 3, with Flatter, Finishes the Heel and Curves the End; Die No. 4 Countersinks for the Claws; Punch Die No. 5 Forms the Claws

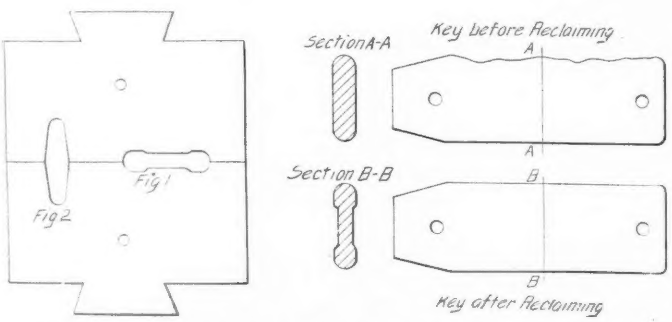
By J. HARKIN
Southern Pacific

A reclaiming plant should be located conveniently to the segregating point of all scrap material and within easy access to the main shops and store. In order to operate a reclaiming plant economically it will be necessary first to determine the kind and the quantity of material of various kinds desired

to be reclaimed; when this has been decided upon there should then be installed the necessary machinery for reclaiming the various articles with the least possible expense.

At the Southern Pacific shops at Sacramento, Cal., brake shoe keys are being made from ¾-in. or ⅞-in. scrap bolts or bars. Brake staffs for flat cars can be made from discarded brake staffs from box cars. We make split keys, angle iron for ladders on box cars, washer plates and door plates from scrap tubes. We use scrap coil springs for making the various styles of bars, packing hooks and packing irons used by the maintenance of way department and car inspectors; these bars vary in size from ⅜-in. round to 1⅜-in. round and from one foot to five feet in length. All our claw bars, lining bars and tamping bar ends are made from scrap tires, as well as headers and dies used on our small size bolt and forging machines. We have been using scrap tire steel for making superheater unit bolts for locomotives with very good success; also we have for some time past been making the flat drills used by the maintenance of way department from scrap files. These drills are ordered in lots of 250 and vary in size from ¾-in. to 1⅛-in. and are usually 6 in. long. We have had very good service from these drills.

We reclaim all scrap 40-ton axles by working them over to 30-ton axles; while the 50-ton axles are reforged to a standard 40-ton axle. These axles are usually reclaimed in a forging machine suitable for such work, but they are also reclaimed with tools made for the purpose under a steam hammer.



Die Blocks Used for Reclaiming Worn Draft Keys—Norfolk & Western

There are usually a number of articles such as handholds, brake rods, couplers, coupler yokes, bolts, nuts, track spikes, switch points, etc., that find their way to the scrap dock from various points on the line. Such material is inspected and much of it reclaimed, or, as some would prefer to say, repaired, and turned over to the store department and carried in stock.

While we give the closest attention to the reclaiming of material at our scrap dock, such as is mentioned above, our greatest success in reclaiming scrap has been accomplished in the rolling mills, where we are using over 5,000,000 lb. per month by rolling it into standard sizes of bar iron from ⅜-in. round to 3½-in. round, and flat bars from ⅛-in. by ½ in. to 1 in. by 12 in. We also manufacture tie plates and angle bars, using material taken from the scrap pile.

By P. T. LAVENDER
Norfolk & Western

The drawing shows a set of hammer dies which have been developed for reclaiming worn draft keys. These dies are very simple to make and can be used in any steam hammer.

We first put the bent and worn draft keys in a furnace and when properly heated straighten them under a hammer. They are then placed in the die shown at the left of the die blocks, which spreads them ¼-in. above size. Then they are placed in the die at the right, which brings them to the size required.

When the operation is completed the key is just as serviceable as one made from new bar stock. We work keys over two and three times before they are sent to the scrap pile.

By T. F. BUCKLEY
Delaware, Lackawanna & Western

Reclamation of scrap materials on railroads has been going on for many years, but lately, due to the high cost as well as the shortage of new material, more attention has been paid to this subject than ever before. Yet it must be recognized that wages have advanced and consequently too much time may be put on many articles, making them more expensive to reclaim than to provide wholly new parts.

Of course scrap is found everywhere from one end to the other of the road and reclamation should take place at a central point, preferably at the company's most important shops where facilities for handling it may be provided. Competent inspectors who thoroughly understand railroad material and its uses should supervise the sorting and reclamation.

Material to be reclaimed should be taken to the main shops, where the necessary steam hammers, shears, and such other facilities as the process requires are located.

Draw-head castings, steel couplers, bolsters and other parts of locomotives and cars slightly cracked but otherwise in good condition should be sent to the shops and have the electric or acetylene torch applied to them. Reclamation by welding has saved thousands of dollars within the past few years.

It may prove economical to provide an auxiliary preparation plant near the scrap dock, where materials can be partially prepared as they are sorted, thus minimizing the cost of handling. This plant should be equipped with bolt threading machines for re-threading bolts, rods, etc., with a nut tapper for retapping old nuts; with punch and shears for making washers and keys. A reclaiming roll for rolling up to 2-in. round and 1-in. by 4-in. flat can profitably be used; there should also be a steam hammer for cutting, straightening and hammering the heavier materials such as scrap axles; for reforming and hammered into round bars 3-in. to 5-in. rounds and making hammered iron into usable sizes, there should be furnace equipments in connection with the hammers and rolls. A plant of this kind can be made to pay for itself in a very short time under favorable circumstances.

In addition to being well versed in the quality of railroad material those in charge of the work should know whether or not it would pay to reclaim in special cases as they arise. Many articles may be reclaimed economically today, but not a month from now. So it is true that as reclamation is a good thing the returns gained thereby are large or small according to the intelligence used in carrying it on.

Discussion

The discussion developed the fact that others are following the practice of reclaiming worn piston heads by building up with Tobin bronze, which Mr. Nielsen mentioned in his paper. It is considered practical to reclaim pistons in this way with a maximum wear up to ¼-in. thick at the heaviest part and extending around approximately one-half the circumference of the piston. This practice has also been used in reclaiming worn slide valves, and in both cases experience has indicated that the reclaimed parts remain in service without further repairs much longer than do new parts.

In answer to a question as to the advisability of manufacturing superheater unit bolts, Mr. Harkin stated that these bolts would not be made in the shop if they could be purchased, but that the use of tire steel, annealed after the bolts had been forged, has been successful. In using tires for the manufacture of parts requiring strength the practice of turning off the flange, and if the tires include inside retaining flanges, cutting these off with the acetylene torch was advocated. An attempt to forge the tire with the flanges left on usually results in the flange turning over and forming a seam in the material.

The greater part of the discussion was devoted to the reclamation of axles. Two general methods are being followed, one in which the whole axle is reworked, the body being drawn out and the journals upset, to reduce the reclaimed axle to the next capacity below that of its original state; and the other reworking the end of the axle only to restore them to the original capacity. The second method requires the addition of material to the ends of the axle. This is being taken care of at the Beech Grove shops of the Big Four by turning off the collar at the ends of the journal, heating the axle and upsetting the journal by forcing a wide angle cone punch into the ends of the axle and then jump welding a plug provided with stock for the collar into the cavity. Some of the members considered this practice open to objection because each time the ends of the axle are upset the distance between the fillets at the wheel seat ends of the journals on the opposite ends of the axle is reduced from 1/4-in. to 1/2-in.

The details of the first method as applied on the Santa Fe were described by George Fraser. The bodies of the axles are first swedged down to increase the length, one half of the axle being heated at a time. The journal collars are then broken down, the ends heated a few inches beyond the wheel seat and upset in a forging machine. The axle is not gripped in the dies but is held against an independent back stop which determines the length. The finished forging has one-half inch of stock for finishing to the required size for the next capacity lower than the original and the size of the body is larger than required by the M. C. B. rules. These axles provide an opportunity for using up wheels with oversize bore.

A question was raised as to the advisability of reclaiming scrap axles because of the uncertainty as to the condition of the material after the axle had been in service long enough to be worn beyond the limit for the original capacity. Some of the members considered the practice inadvisable, unless the material in the axle were reworked throughout its entire length.

Association Business

A Committee on Amalgamation with the American Railroad Association, Section III—Mechanical, appointed subsequent to last year's convention, presented a brief report outlining the probable status of the association should it amalgamate with Section III—Mechanical. The association authorized the committee to conduct the necessary negotiations with a view to accepting the invitation of Section III—Mechanical—of the American Railroad Association to become a member of the American Railroad Association—Section III—Mechanical—subject to a vote of approval at the next convention.

The secretary-treasurer reported a total membership of 245 at the close of the year and 21 new members were received during the convention. The balance in the treasury showed an increase of \$141.58 last year to \$227.82 this year. In order to continue to meet the increased cost of conducting the affairs of the association, however, the dues for the coming year were increased from \$4.00 to \$5.00 a year.

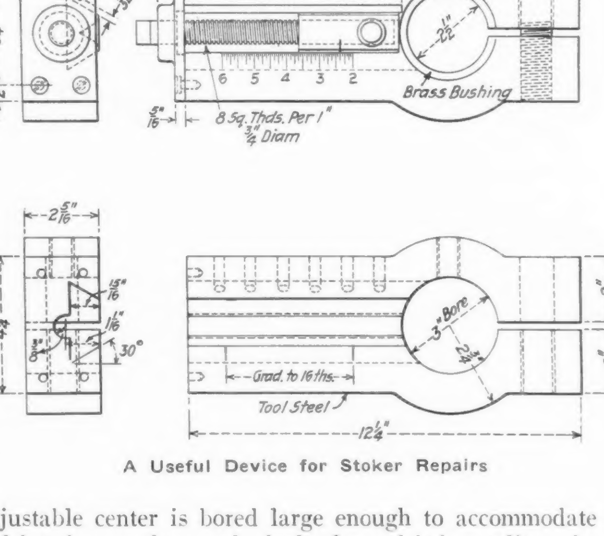
The following officers were elected to serve for the coming year: president, Joseph Grine, (New York Central); first vice-president, George Hutton, (New York Central); and second vice-president, S. Lewis, (Canadian National). W. J. Mayer (Michigan Central), who was first vice-president during the past year, was elected to the presidency; but owing to the demands that he be made secretary-treasurer to succeed A. L. Woodworth, who asked to be retired following a continuous service in this office of 22 years, Mr. Mayer resigned the presidency to accept the office of secretary-treasurer.

Montreal, Quebec, was unanimously chosen as the place for the next convention, with the provision, however, that the executive committee be empowered to make other arrangements should the best interest of the Association so require.

ADJUSTABLE CENTER BLOCKS FOR CRANK SHAFTS

By J. K. BLAIR
Norfolk & Western, Roanoke, Va.

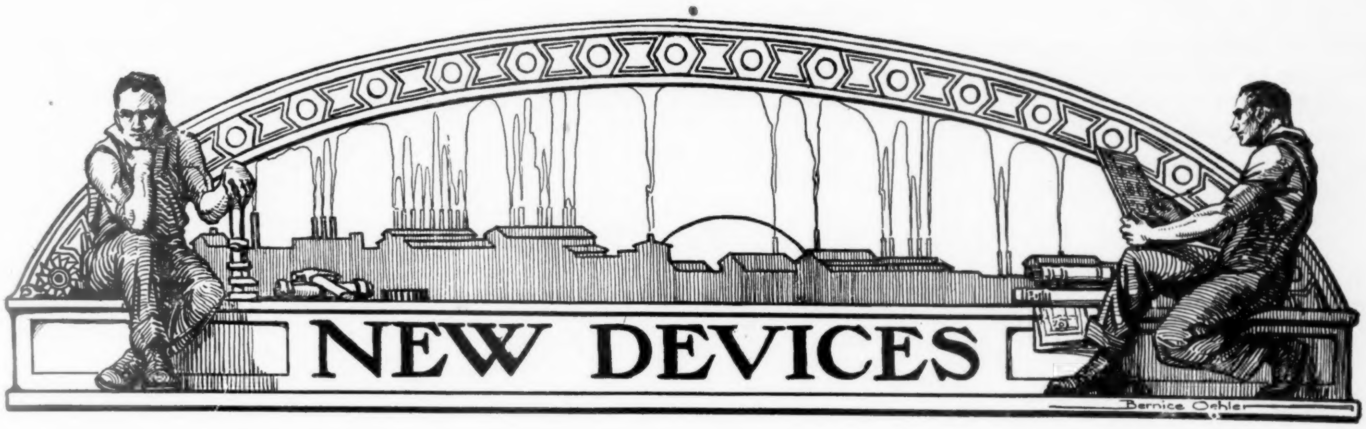
In turning crank shaft bearings, it is usually necessary to make center blocks to accommodate every different diameter of end bearing and crank throw. As this is laborious and costly, the device illustrated herewith will be found a useful adjunct in the machine shop. It has been found very handy for turning the wrist bearing on various styles of stoker cranks and similar work. The block which carries the



A Useful Device for Stoker Repairs

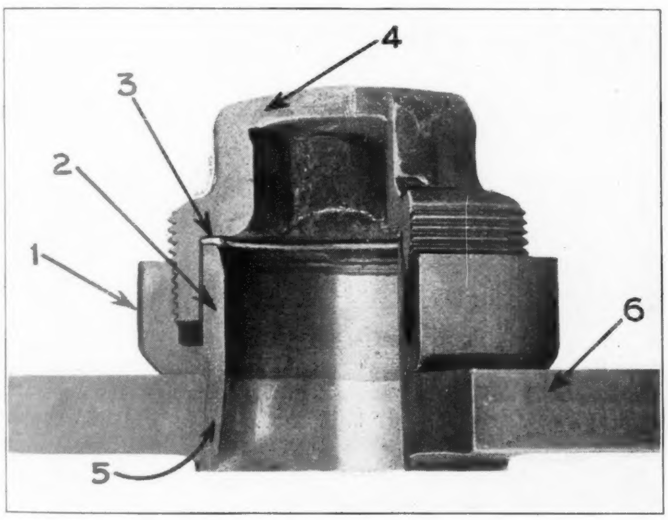
adjustable center is bored large enough to accommodate the end bearing on the crank shaft, the end being split and a set screw placed in the side to hold the parts securely. In clamping smaller sizes, the hole is bushed. The sliding center works in a dove-tailed groove fitted with an adjustable gib and is moved back and forth by the screw as shown. A scale on the block indicates the offset between the centers of the bearings.

British Link Truing Device



Safety Locomotive Boiler Washout Plug

A WASHOUT PLUG of new design has been placed on the market by the Housley Flue Connection Corporation, Indianapolis, Ind. This plug has been in use for some time and has been thoroughly tested under service conditions. For test purposes a pressure of 1,800 lb. cold water has been applied and it is reported that the plug withstood the pressure without leaking. The plugs used in the test were not especially designed, but were taken from the stock room.



Housley Safety Washout Plug

The construction of the plug is indicated in the cross-sectional view illustrated. The sleeve *1*, which is installed in the boiler sheet, is rolled in on a three-degree taper and remains permanently in place, special rolls and expanders being provided for this purpose. A particular feature of the plug is the protecting wall *2*, which safeguards the threads against smashing or distortion caused by washing rods and hose nozzle. It also prevents water from touching the threads, allowing no scale, rust or sediment of any kind to form. The top of the protecting wall is the seating face for the gasket *3*. This gasket fits snugly in the top of the plug cap in a special groove and does not drop out when the cap is removed. It is this gasket that solves the problem of leaky plugs, because when the plug cap is screwed down tight on a soft copper gasket leaks are practically impossible.

The plug cap *4* is the only part that is removed for a washout and in replacing, the caps cannot be cross-threaded because the protecting wall acts as a pilot. The nipple *5* or the lower part of the sleeve which fits in the boiler is rolled in the sheet on a three-degree taper, the larger end of the hole being in the boiler; *6* is the boiler sheet. Owing to the absence of scale and rust and the good condition of the threads, it is stated that one man can readily remove these plugs from boilers.

The Germ Process of Compounding Oils

PAPERS on the Theory and Practice of Lubrication by Henry M. Wells and James E. Southcombe, of the Henry Wells Oil Company, London, Eng., were read in Pittsburgh recently. The authors explain the rationale of the superior lubricating properties of fatty oils and of oils compounded with fatty oils over "straight" mineral oils (i. e. mineral oils not compounded). The property has hitherto been mentioned by various observers but left in that position. This led to an examination of the principles on which lubrication depends. It was demonstrated that liquids which wet solid surfaces are lubricants, while liquids which do not wet them are not lubricants; that one property which differentiates them is largely that of capillarity, or interfacial tension; that the fatty acids in fatty oils perform the functions of lubrication and not the fatty oil per se. It was also found that if the fatty acid be extracted from a fatty oil it is little if any better than a mineral oil as a lubricant and that if a fatty acid in small quantities be added to mineral oils, their lubricating properties are very appreciably enhanced. Results in the laboratory were confirmed by several independent authorities.

On the practical side, the authors cite many examples where fatty oils, or oils compounded with fatty oils, have been entirely and successfully replaced in actual practice by Germ Process oils for lubrication of steam engines, gas and oil engines and many types of mehanism. Results of trials of marine engine oil on a large scale over 18 months, by the British Admiralty were cited. Germ Process oils are cheaper than fatty compounded oils, and are suitable for the heaviest work in all climates.

The title "Germ Process" selected by the authors is purely arbitrary—chiefly from the fact that hitherto engineers and chemists have had an aversion for the word "acid" connected with any oil. The authors not only dissipated that

fear by proving it was grounded on a complete misapprehension of its functions, but proved that the feared fatty acid was a very useful ally when its functions are understood and controlled, which, it is stated, the Germ Process ensures. The claim is made that by this method of preparation superior oils can be obtained at a fraction over the cost of mineral oils. The Germ Process is the subject of patents in America, in the United Kingdom and in Europe.

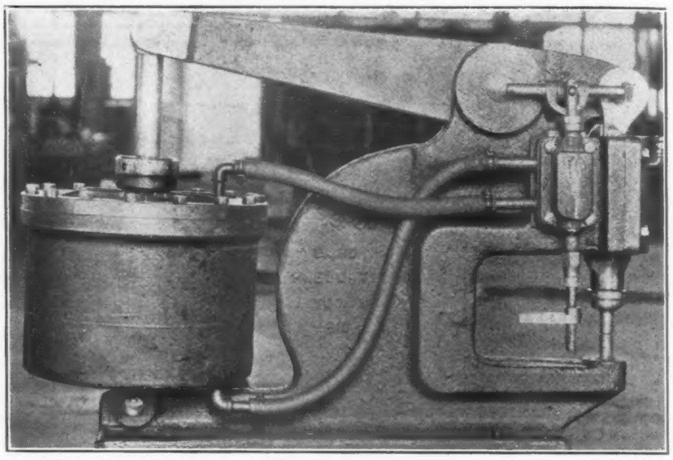
Portable Pneumatic Punch and Riveter

THE illustration shows a new combination punch and riveter designed and built by the Baird Pneumatic Tool Company, Kansas City, Mo. It is adapted to the punching of light structural shapes in shops where the range of work is of small dimensions. By taking out the punch and die and inserting rivet dies of the proper size, the machine may be operated as a riveter and can be used effectively on the fabrication of light frame work. The air cylinder is so cushioned as to prevent injury to the mechanism when used as a punch.

The tool is operated by a fourway valve, by foot pedal and hand movement, depending on whether it is used as a stationary or portable unit.

The machine is made with both 1-in. and 2-in. die travel and has a punching capacity of 1/8-in. to 5/8-in. holes in cold 3/8-in. plate, and has a riveting capacity of 3/8-in. cold or ⅝-in. hot rivets.

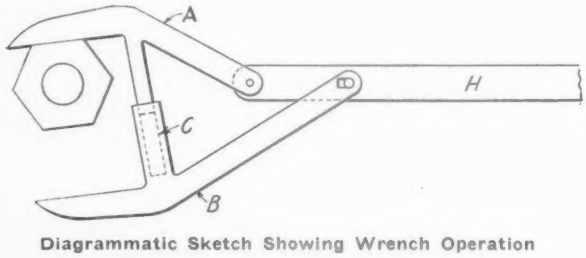
The tool delivers 35 tons pressure on the rivet punching dies and weighs 500 lb. complete. This punch and riveter can be used to good advantage on the quantity production of small shapes. It is portable, takes up but little floor space, and is stated to be economical in air consumption which is an important factor in machines of this character.



Baird Air Operated Punch and Riveter

Automatic Wrench of Simple, Compact Design

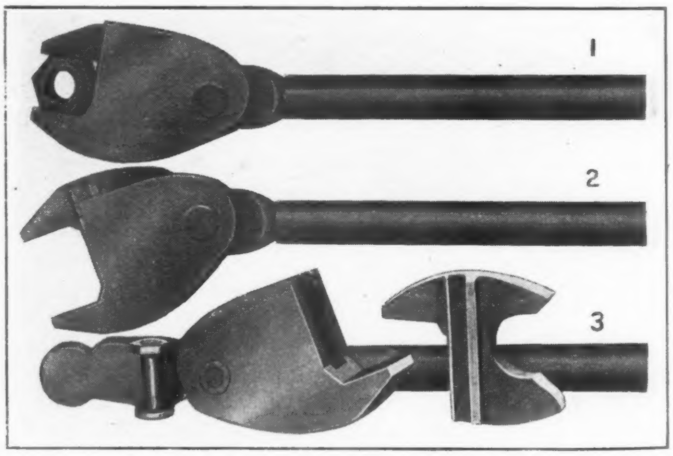
A SIMPLE, compact wrench, which is virtually automatic in action without the agency of a ratchet, has been developed recently. It was first used as a track wrench, but is equally applicable to smaller sizes of nuts. As illustrated, there are only four pieces to the wrench, the handle, interior jaw, exterior jaw and hinge pin. The interior jaw has a socket that fits over a knuckle on the end of the handle, while the exterior jaw encloses the interior jaw and is pivoted on a pin located a short distance behind the center of the socket about which the interior jaw revolves. The engaging faces of the two jaws have corresponding grooves so that the two jaws slide in a fixed relation to each other as they rotate about their respective centers on the handle.



Diagrammatic Sketch Showing Wrench Operation

The operation of the wrench is best understood by reference to the diagrammatic sketch. In this sketch the handle is represented by *H*, the interior jaw by *A*, the exterior jaw by *B*, while the engaging grooves of the two jaws are simulated by the plunger and cylinder arrangement at *C*. It is clear that when the handle is turned in a clockwise direction, the two jaws move away from each other and that when the handle is turned in the opposite or counter-clockwise direction, the two jaws move towards each other. The pin hole in the handle is slotted a sufficient amount to avoid any binding with the varying angular positions of the handle.

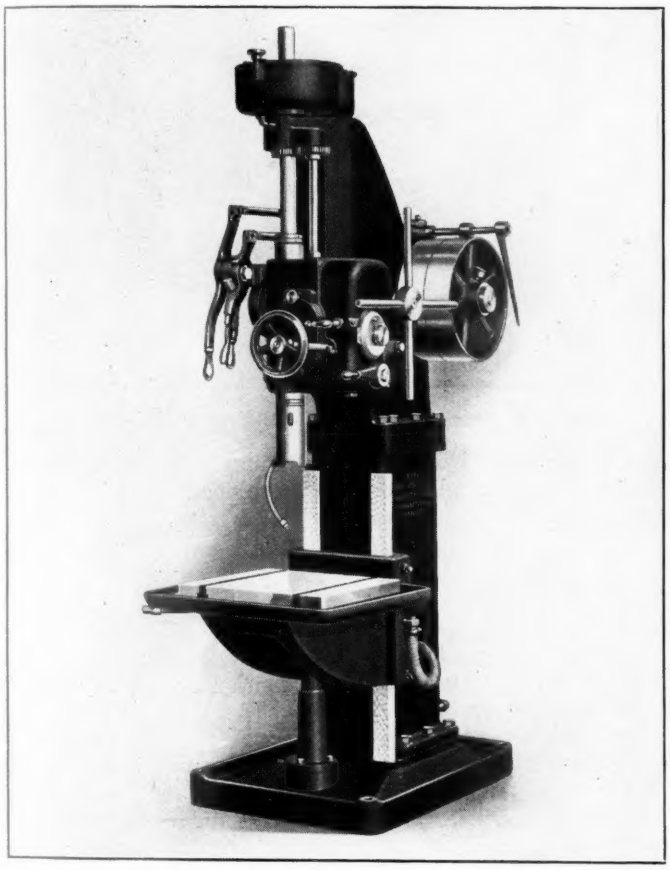
In using this wrench it is put on the nut in a position such that the direction in which the bolt is to be turned is the same as the direction in which the handle must be pulled in order to bring the jaws together. The wrench is held by the operator so that the nut is always in contact with the interior (upper) jaw. When the handle is turned back, the exterior jaw will clear the nut. The action is automatic, the jaws separate as the handle is pulled back to take a new grip and come together again the instant that the handle is pulled forward to turn the nut. The wrench is manufactured by the Allan-Diffenbaugh Wrench & Tool Company.



Allen-Diffenbaugh Automatic Wrench

High Capacity Single Purpose Drill

DESIGNED to meet the demand for a single purpose drill of simple and rugged construction, a machine has been placed on the market recently by the Minster Machine Company, Minster, Ohio. It is well adapted for use on quantity production work. Referring to the illustration, the power is transmitted to a large driving pulley running at 600 r.p.m., and then through accurately ground, high carbon steel shafting to the hardened, stub tooth transmission gears. The gears are all accurately ground.



No. 12 Minster Junior Drill

This machine is equipped with three mechanical speed changes which are obtained through a sliding gear in the gear box, the teeth of which are rounded so as to enable the operator to change gears readily. The drive then passes through the hardened mitre gears to the vertical driving shaft, at the upper end of which are located the speed change gears. These gears in turn mesh with the gears on the flanged spindle sleeve. The drill comes regularly equipped with two sets of speed change gears, giving six speed changes, but any desired speed can be obtained by changing the combination of gears both on the vertical drive shaft and spindle sleeve.

A vertical shaft at the front of the machine drives the feedbox mechanism. The feedbox shafts are all accurately ground and cut steel gears are used throughout. Two mechanical feed changes are provided in the feedbox, which are compounded by transposing gears located conveniently on the front of the machine. The machine comes regularly equipped with one set of transposing gears, giving four feed changes. Any desired feed may be obtained by changing the feed transposing gears. The feedbox mechanism transmits its motion to the worm shaft, which in turn engages the large worm wheel keyed to the pilot shaft. Upon this shaft, a wide faced, stub tooth pinion is cut which engages the feed rack on the spindle sleeve. An efficient automatic feed disengaging device is provided.

The spindle, which is made of high carbon forged steel, is driven by a sleeve upon which are mounted the driving gears. Two driving keys are mounted diametrically opposite in the spindle sleeve, which engage two keyways in the spindle. This method of driving divides the strain on the spindle and thereby eliminates any trouble which may be occasioned through the spindle binding. The two driving keys are held in position by screws.

The No. 12 Minster Junior drilling machine can be provided with a compound table in place of a plain table if desired, the compound table being of heavy construction and thoroughly gibbed to provide for extra heavy service. The bases of all machines are provided with slots for receiving adjustable motor bases. The motor is mounted directly upon this base and may be attached after the machine has been installed; since it will be necessary to drill but four holes in the base to mount the motor, the adjustable slides which are usually furnished with motors can be omitted. A 10-h.p. constant speed motor running at 1,100 to 1,300 r.p.m. is recommended.

Screw Driver Attachment for Air Motors

FOR use in pattern, cabinet, or any wood working shops where many screws have to be driven, the screw driver attachment illustrated has been developed as a time and labor saver by the Independent Pneumatic Tool Company, Chicago. It can be fitted to the spindle of an air motor or readily adapted to use with electric drills if desired.

It is stated that an experienced operator using one of these screw driver attachments can drive fifty screws per minute, with less effort and make a better finished job than by hand. The principle of operation is simple. Under normal conditions, the socket holding the screw driver is disengaged from the motor spindle so that the screw driver may be placed in the head of the screw while the motor is revolving. Pressure on the motor causes a shoulder on the part connected to the motor spindle to engage a recess in the socket and the screw driver revolves with the motor spindle. Removal of the pressure causes the parts to disengage. The arrangement illustrated measures 15 in. over all and will drive No. 12 wood screws 1¾ in. long.

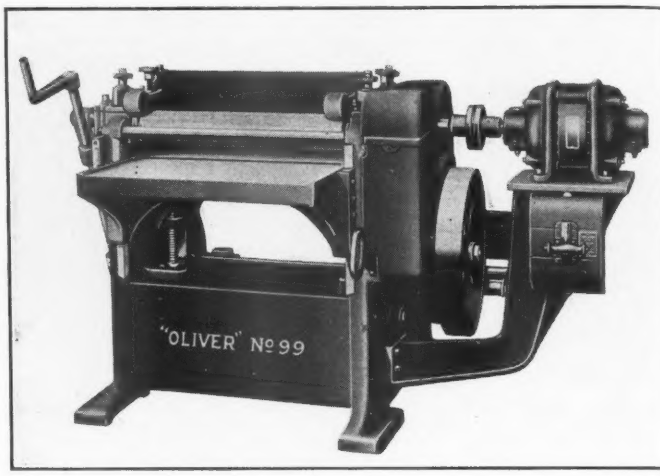
Thor Screw Driver Attachment

Direct Motor Drive for Surface Planer

THE application of the individual motor drive to railway shop machinery has been extended to woodworking machines, a recent example of which is the motor-driven surfacer or surface planer developed by the Oliver Machinery Company, Grand Rapids, Mich. This machine is driven without belts or driving pulleys by means of a motor coupled directly to the cutting cylinder and providing a speed of 3,600 r.p.m. In order to provide the proper number of cuts per minute three high speed knives are furnished in the cutting head.

The particular advantages of this form of drive are a considerable saving in floor space, increased efficiency due to the lack of belts, greater safety in machine operation and the fact that the machine can be placed anywhere in a shop, regardless of the position of line shafts.

The Oliver single-cylinder surfacer is made of cast iron sides and ribbed girts, carefully machined and bolted together. Ample material in the flanges reduces vibration to a minimum and provides substantial floor support. An improved type of forged crucible steel cylinder, carrying two knives and steel chip breakers is provided. Two pressure bars, one acting before and the other after the cylinder, hold the work to the table. The front bar or chip breaker yields to any quality of cut. Positive feed is provided by means of $3\frac{1}{2}$-in. forged steel feed rolls. The machine is designed to plane six inches thick and 20 in. wide, with a

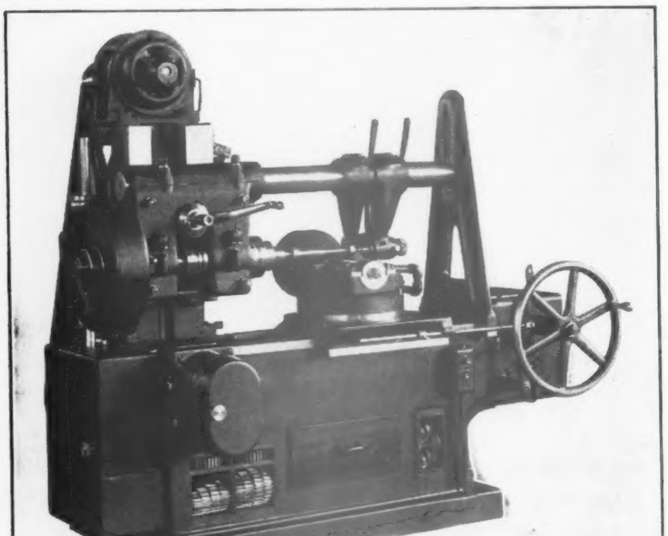


Surface Planer Arranged for Direct Motor Drive

lineal rate of feed of 24 ft. per minute. A five-horsepower motor is recommended to drive the planer.

Spur and Spiral Gear Hobbing Machine

FOR cutting spur and spiral gears also splining shafts and cutting ratchets and sprockets, the machine illustrated has been placed on the market recently by the Cincinnati Gear Cutting Machine Company, Cincinnati, Ohio. The gear hobber is particularly adaptable to the quantity production of spur and spiral gears but can be



Cincinnati 16-In. Gear Hobbing Machine

readily set up for machining a single spur gear. In cutting spiral gears, however, its advantage is only manifest in quantity production, the requirements of the set-up being such as not to lend themselves quickly to cutting occasional gears. The hobber is supplied with standard parts and change gears but for the manufacture of spiral gears it is necessary to provide special change gears.

Strength and rigidity are secured by the generous dimensions of the bed and housing of the hobber. The metal is distributed to provide the greatest stiffness possible and this contributes to the accuracy of the machine. The work spindle is horizontal and is supported rigidly by two long bearings in the work saddle. Both bearings are bronze bushed and the front bearing is tapered for taking up wear. The work saddle is taper gibbed to long narrow guides in a manner to prevent any sagging when the clamping bolts are loosened. Elevating and lowering are accomplished by means of a crank handle, the movement being recorded by a graduated dial reading to .001 in. The load is supported on ball bearing thrust collars making the action smooth and even. The indexing mechanism consists of a double thread worm and a cast iron worm gear which are entirely enclosed and run in a bath of oil, suitable adjustment being provided to take up wear. The indexing is continuous and automatic.

The guide of the hob slide is exceptionally long with square ways taper gibbed to reduce binding action. The design and construction are such as to provide for the proper swiveling of the hob spindle. This can be adjusted to approximately fifty degrees either side of zero and is set by a vernier reading to five minutes. An automatic stop for the entire machine at any point is provided for use on either belt driven or motor driven equipment. There is also a trip to stop the feed mechanism only.

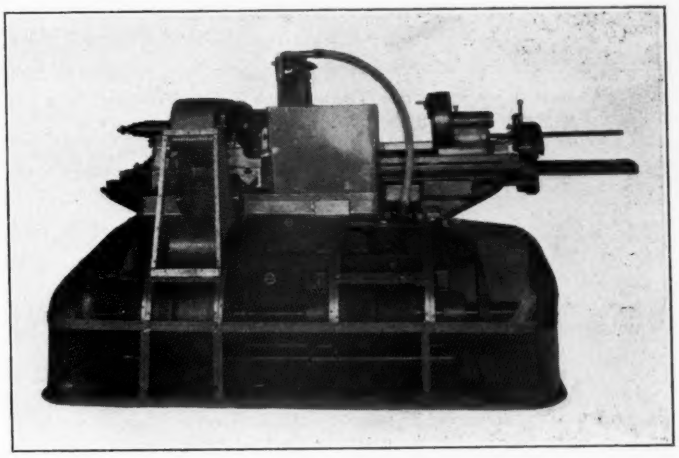
Changes in speeds and feeds are secured by means of removable change gears, a sufficient range being provided to meet all average conditions. Maximum production is insured by a cutting lubricant system and pump of ample capacity. Spur gears up to $17\frac{1}{4}$ in. in diameter with a 12 in. face and spiral steel gears with a diametral pitch of 3 can be cut. The maximum distance from the hob center to the spindle nose is $19\frac{1}{2}$ in. The maximum diameter of the hob is $4\frac{1}{2}$ in. Twenty-six changes of hob feed can be obtained and eight changes of speed. When a belted drive is provided as shown, the driving pulley is 15 in. in diameter with a $3\frac{1}{4}$ in. face to run at a speed of 400 r.p.m.

Plain Grinder With New Phantom Guards

PRACTICALLY all grinding machines made by the Modern Tool Company, Erie, Pa., are now equipped with new phantom guards as illustrated. The new guard, supplied with the machine and without extra cost, is a combination of expanded or perforated metal riveted to an angle iron frame, thus assuring both lightness and strength. Objections heretofore found with the old type of heavy, unwieldy, cast iron guard have been eliminated and the new type is light and easily handled. It affords pratically complete visibility of all moving parts which the old type of guard concealed. All gears, pulleys, and belts are completely enclosed.

The Modern phantom guard is a space-saver and permits machines to be set closer together. It is built to follow the lines of the machine. The corners, being rounded instead of square, do not project into the passageway. Hinged portions and hand holes make lubrication and minor adjustments easy without the necessity of removing the guard. The heavy cast iron type guard is cumbersome, and hard to handle, experience proving that lubrication and adjustments were often neglected because of difficulty in this respect.

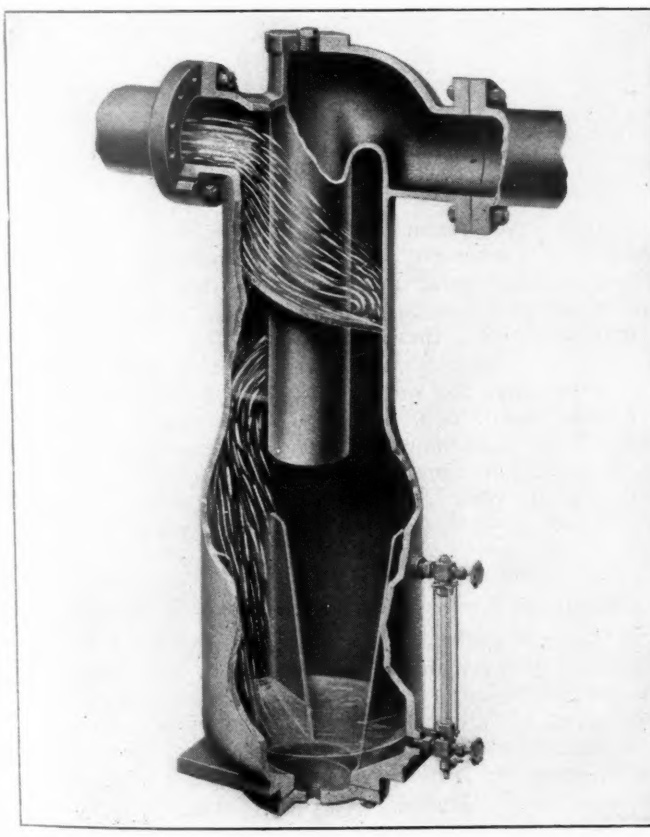
The feature of visibility will not only permit all moving parts to be seen, and watched, but will act as a check against accumulation of dirt. The new guard is supplied as a unit and can be placed in position or removed without the use of a wrench or screw driver.



Modern Grinder With Phantom Guard

Separating Water From Compressed Air

ALL railway shop men are familiar with the trouble due to condensed water getting into pneumatic tools and air operated devices throughout the shop. A simple device for removing this water from the air mains is shown in the illustration. It is known as the Stratton air separator, and is manufactured by the Griscom-Russell Company, New York.



Stratton Air Separator

The separator consists of a close grain, iron casting, designed to withstand a pressure of 160 lb. per sq. in. As air and the water come from the condenser they are compelled to follow a helical path which causes a swirling motion. The water, being heavier, is thrown by centrifugal force out of the path of the air and against the walls of the separator which it meets at an angle. There is no spatter or splash and the water follows the walls until its motion is checked in the receiving space at the bottom, from which it may be drained. The operation of the separator is purely mechanical and it is essential, for satisfactory results, that air entering the separator shall be at a sufficiently low temperature to insure all the water vapor being condensed. In order that the separation shall take place when the air is at its lowest temperature, it is desirable to install the separator as near as possible to the point at which the air is to be used. In other words, it is better to install a number of small separators on branch lines than to install one large separator on the main line from the compressor. In case of long air pipe lines out of doors where there is a possibility of freezing, the separator should be placed in the line at a point just before the pipe leaves the building.

The water level in the separator is indicated by a glass gage as shown and for convenience in operation it is recommended that a trap be installed to automatically drain the separator of water. Separators having various arrangements of inlet and outlet can be supplied to meet different piping arrangements and with air inlets up to 8 in. in diameter.

At a recent congress of the French Federation of Railwaymen, the former secretary, M. Bidegaray, was re-elected by 34 votes against 19 cast for Lardeaux, the extremist, who took an active part in promoting the recent abortive strike, according to a note in the Railway Gazette, London. M. Bidegaray was considered too moderate for the revolutionaries, who at the last congress ousted him from his position and then declared a strike. Three of the extremists are now under arrest and a warrant has been issued for the arrest of the fourth, who has so far eluded the police.

Railway Mechanical Engineer

(*Formerly the* RAILWAY AGE GAZETTE, MECHANICAL EDITION *with which the* AMERICAN ENGINEER *was incorporated*)

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY

EDWARD A. SIMMONS, *President* HENRY LEE, *Vice-President and Treasurer*
L. B. SHERMAN, *Vice-President* SAMUEL O. DUNN, *Vice-President*
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Cable Address: Urasigmec, London

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Entered at the Post Office at New York, N. Y., as mail matter of the second class.

Subscriptions, including the eight daily editions of the Railway Age, published in June, in connection with the annual convention of the American Railroad Association. Section III—Mechanical, payable in advance and postage free: United States, east of the Mississippi river, $3.00 a year; west of Mississippi river and Canada, $4.00 a year; elsewhere $5.00, or £1 5s. 0d. a year. Foreign subscriptions may be paid through our London office, 34 Victoria Street, S. W. 1., in £ s. d. Single copy, 30 cents.

WE GUARANTEE, that of this issue 10,500 copies were printed; that of these 10,500, 9,216 were mailed to regular paid subscribers, 14 were provided for counter and news company sales, 259 were mailed to advertisers, 32 were mailed to employees and correspondents, and 979 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 105,150, an average of 11,683 copies a month.

The *Railway Mechanical Engineer* is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

C. D. Young, general supervisor of stores of the Pennsylvania, has been appointed representative of the American Society for Testing Materials on Engineering Council, succeeding Albert Ladd Colby.

The Locomotive Superheater Company has received orders for 92 superheater equipments to be applied to seventy-five 4-6-0 locomotives and seventeen 2-10-0 locomotives to be built by 12 different locomotive builders in Belgium.

The Interstate Commerce Commission has ordered Class I railroads to file with it quarterly reports giving particulars of the number of employees of various classes in the service at specified times, of the service rendered by such classes of employees and of the compensation paid for that service.

A Materials Handling Section of the American Society of Mechanical Engineers was organized at a meeting in the Engineering Societies building, New York, August 13. Robert M. Gates, Lakewood Engineering Company, acted as temporary chairman. A nominating committee was appointed and ballots will be sent out for the election of officers just as soon as the committee makes its report.

The Russian Soviet government has sent Messrs. Krassin and Ivitsky to London to negotiate for the purchase of locomotives. Mr. Krassin is a representative of the Soviet government and Mr. Ivitsky is the engineer in charge of design. It is reported that Russia needs 5,000 locomotives, but these gentlemen will negotiate for the purchase of from 200 to 300. However, the Polish crisis has temporarily held up the negotiations.

The Joint Conference Committee of the national societies of civil, electrical, mechanical and mining engineers has issued an invitation to engineering and allied technical organizations to become charter members of the Federated American Engineering Societies, the organization conference of which was held in Washington, D. C., on June 3 and 4. The engineering societies are also asked to appoint delegates to the first meeting of the American Engineering Council, which will be held this fall.

The claim made by the railway car builders and repairers of Great Britain for an increase of 6 pence (12 cents) per hour on time rates with an equivalent increase on piece rates and of 3 pence (6 cents) per hour for apprentices has been refused by the Industrial Court. The employers contended that the increases already granted were sufficient to meet the increased cost of living and added that the high charges in connection with the car building trade were already causing a serious fall in the demand.

A despatch from Dallas, Tex., published in the Manufacturers Record states that $18,000,000 will be spent by the Santa Fe system for new equipment, to be delivered at the earliest possible moment. Orders have been placed with manufacturers for 50 locomotives of the most modern type for both passenger and freight service, 3,000 gondola cars, 2,500 refrigerator cars and 5,000 box cars. Fifteen hundred of the box cars will be built especially for the handling of automobiles and furniture. The $18,000,000 also provides for the purchase of a large number of passenger, mail, baggage and express cars.

A sectional committee of the American Engineering Standards Committee, 29 West Thirty-ninth street, New York, held an organization meeting on June 11, to undertake the standardization of plain cylindrical gages for general engineering work, under the sponsorship of the American Society of Mechanical Engineers. The immediate occasion for undertaking the work was a request of the British Engineering Standards Association for co-operation on the subject. It is understood that this committee will recommend to the American Engineering Standards Committee that the scope of the work should be broadened so as to cover all plain limit gages for general engineering work.

Chicago and Pittsburgh Sections, American Welding Society

A Chicago section of the American Welding Society was organized at a meeting of the members of the welding trade in Chicago on August 3. Representatives were in attendance from many of the railroads and also from many of the larger local industries. M. B. Osburn, assistant superintendent of the Pullman Car Works, was elected chairman; O. T. Nelson, president of the General Boilers Company, was elected vice-chairman, and L. B. Mackenzie, president of the Welding Engineer, secretary and treasurer.

The organization of the Pittsburgh Section of the American Welding Society was completed at a meeting held in the Chamber of Commerce auditorium at Pittsburgh, Pa., on August 12. Officers of the section elected at the meeting

are: Chairman, J. D. Conway, secretary and treasurer Railway Supply Manufacturers' Association; first vice-chairman, Dr. R. H. Brownlee, Brownlee Consulting Laboratories; second vice-chairman, H. H. Maxfield, general superintendent motive power, central region Pennsylvania System; temporary secretary, F. W. Tupper, American Welding Society; treasurer, F. O. Gardner, Pittsburgh Testing Laboratory.

MEETINGS AND CONVENTIONS

American Steel Treaters' Society.—The American Steel Treaters' Society and the Steel Treating Research Society will hold a joint convention at the Commercial Museum, Philadelphia, Pa., on September 14 to 18, inclusive. A comprehensive program will be presented covering all phases of the heat treatment of steel, including pyrometry, electric, gas and oil fired furnaces, forging temperatures, quenching mediums, carbonizing and the treatment of various special alloy steels. Several papers of especial interest to railroad men will be presented, the subjects including the heat treatment of locomotive forgings. Over 80,000 sq. ft. of floor space in the Commercial Museum will be devoted to an exhibit of heat treating appliances and heat treated products. More than 125 companies will be represented.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD ASSOCIATION, SECTION III—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.
SECTION III.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago. Convention, September 14-16, New American House, Boston.

AMERICAN RAILROAD ASSOCIATION, SECTION VI.—PURCHASES AND STORES.—J. P. Murphy, N. Y. C., Collinwood, Ohio.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. B. Baker, Terminal Railroad, St. Louis, Mo.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, 1145 E. Marquette Road, Chicago. Convention September 1-3, Hotel Sherman, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

AMERICAN STEEL TREATERS' SOCIETY.—W. H. Eiseman, 154 E. Erie St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

CANADIAN RAILWAY CLUB.—W. A. Booth, 131 Charron St., Montreal, Que. Next meeting, September 14, Paper on Car Records and Their Relation to Transportation and Accounting will be presented by J. A. Altimas, Canadian Pacific.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago. Next meeting September 8, at Hotel Morrison, Chicago. Paper on Reclamation of Car Materials will be read by J. L. McCann, B. & O.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, secretary Federal Reserve Bank Building, St. Louis, Mo. Meetings first Tuesday in month at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York Next meeting September 10, Hotel Statler, Buffado, N. Y. Paper on Upkeep of Freight Car Equipment will be read by J. W. Senger, N. Y. C.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—J. C. Keene, Decatur, Ill. Convention, September 14-16, Windsor Hotel, Montreal, Que.

CINCINNATI RAILWAY CLUB.—H. Boutet, 101 Carew Building, Cincinnati, Ohio Meetings second Tuesday in February, May, September and November.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 702 East 51st St., Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn. Convention Sept. 7-10, 1920, Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Next meeting October 12.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York. Next meeting, September 17. Discussion of the Association of Railway Executives' plans for increasing the efficiency of operation of the railways

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgrebe, 623 Brisbane Building, Buffalo, N. Y. Meetings third Wednesday in month, Statler Hotel, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Next meeting, September 3. Problems of the short line railroads will be discussed by various speakers.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Meetings fourth Friday in month, except June, July and August, American Club House, Pittsburgh.

ST. LOUIS RAILWAY CLUB.—J. B. Frauenthal, Union Station, St. Louis, Mo. Meetings second Friday in month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. R. R., Buffalo, N. Y. Convention September 14, Chicago.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, Chicago. Next meeting September 20. The building of a locomotive in the plant of the

PERSONAL MENTION

GENERAL

C. H. BILTY has been appointed mechanical engineer on the Chicago, Milwaukee & St. Paul, with headquarters at Milwaukee, Wis., having returned from service with the United States Railroad Administration.

W. J. BOHAN, assistant mechanical superintendent of the Northern Pacific, with headquarters at St. Paul, Minn., has been appointed assistant general mechanical superintendent with the same headquarters.

J. B. BROWN, master mechanic of the East Carolina division of the Seaboard Air Line, with headquarters at Andrews, S. C., has been transferred to succeed F. W. Knott as master mechanic of the Alabama division, with headquarters at Savannah, Ga.

R. M. CROSBY, general master mechanic of the Northern Pacific with headquarters at Tacoma, Wash., has been promoted to mechanical superintendent of the lines west of Paradise, Mont., with the same headquarters.

H. M. CURRY, mechanical superintendent of the Northern Pacific, with headquarters at St. Paul, Minn., has been appointed general mechanical superintendent with the same headquarters.

H. K. FOX, acting mechanical engineer of the Chicago, Milwaukee & St. Paul, has been appointed engineer of tests with headquarters at the Milwaukee shops, Milwaukee, Wis.

E. R. GORMAN, assistant superintendent of the Eastern division of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at Eau Claire, Wis., has been appointed acting superintendent of motive power and machinery, with headquarters at St. Paul, Minn. Mr. Gorman succeeds J. O. Enochson, who has been relieved on account of ill health.

W. T. HAWKINS has been appointed fuel agent of the Missouri Pacific, succeeding W. J. Roehl, who has been transferred.

GEORGE F. HESS, superintendent of machinery of the Kansas City Southern, has been appointed superintendent motive power of the Wabash, with headquarters at St. Louis, Mo., succeeding E. F. Needham, relieved of those duties at his own request because of ill health. Mr. Hess was born in Fort Wayne, Ind., and entered railway service as a messenger boy in the mechanical department of the Pennsylvania in 1886. After a short service as machinist apprentice in the Pennsylvania shops at Ft. Wayne he entered the employ of the Cleveland & Pittsburgh at Wellsville, Ohio, as a machinist. He was later employed by the Cleveland, Canton & Southern at Canton, Ohio; by the Atchison, Topeka & Santa Fe at Raton, N. M., and by the Wabash at Ashley, Ind. In 1897 he was promoted to roundhouse foreman at Montpelier, Ohio, and shortly after was transferred to Delray, Mich. He entered the service of the Grand Trunk as general foreman at Detroit, Mich., in 1899, and was later transferred to Battle Creek, Mich. In March, 1901, he was appointed enginehouse foreman on the Chicago, Rock Island & Pacific at Pratt, Kan. He was later transferred to Caldwell, Kan., where he remained until promoted to general foreman at the Forty-seventh street (Chicago) shops. He entered the service of the Baltimore & Ohio in March, 1903, as a master mechanic, with headquarters at Lorain, Ohio, and served in the mechanical department of this road during the next eight years. In August, 1911, he was appointed

superintendent of machinery on the Kansas City Southern, with headquarters at Pittsburgh, Kan., which position he occupied at the time of his recent appointment.

E. W. HOPP, master mechanic of the Racine and Southwestern division of the Chicago, Milwaukee & St. Paul, with headquarters at Milwaukee, Wis., has been transferred to Aberdeen, S. D., as master mechanic of the Aberdeen division, succeeding G. Lamberg.

W. J. HUGHES has been appointed master mechanic of the Racine and Southwestern division of the Chicago, Milwaukee & St. Paul, with headquarters at Milwaukee, Wis., succeeding E. W. Hopp.

C. G. JUNEAU, recently appointed acting master car builder of the Chicago, Milwaukee & St. Paul, has now been appointed master car builder, with office at Milwaukee, Wis.

G. LAMBERG, division master mechanic of the Aberdeen division of the Chicago, Milwaukee & St. Paul, with headquarters at Aberdeen, S. D., has been promoted to superintendent of shops, with headquarters at Minneapolis, Minn.

LEWIS K. SILLCOX, whose appointment as general superintendent motive power of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, was announced in the August issue, was born in Germantown, Pa., on April 30, 1886, and was educated at Trinity School, New York, and the Mechanical and Electrical Institute of Brussels. He entered railway service in 1903 as an apprentice in the High Bridge shops of the New York Central, leaving there in 1906 to go with the McSherry Manufacturing Company at Middletown, Ohio. He resigned from that company as assistant shop superintendent in 1909 to become shop engineer of the Canadian Car & Foundry Company at Montreal. He left his position with the latter company in 1912 to become mechanical engineer of the Canadian Northern. In 1916 he was appointed to a similar position with the Illinois Central in charge of car work, from which he resigned on February 1, 1918, to accept an appointment as master car builder of the Chicago, Milwaukee & St. Paul.

On June 1, of this year the appointment of Mr. Sillcox as assistant general superintendent motive power of the Chicago, Milwaukee & St. Paul became effective.

SILAS ZWIGHT, assistant mechanical superintendent of the Northern Pacific, with headquarters at St. Paul, Minn., has been promoted to mechanical superintendent of the lines east of Paradise, Mont., with the same headquarters.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

G. F. EGBERS, master mechanic on the Northern Pacific with headquarters at Pasco, Wash., has been appointed master mechanic of the Idaho division, with headquarters at Parkwater, Wash.

H. MCLENDON, general locomotive foreman of the Seaboard Air Line at Savannah, Ga., has been promoted to master mechanic of the East Carolina division, with headquarters at Andrews, S. C., succeeding J. B. Brown.

JAMES SIMPSON, master mechanic on the Northern Pacific, with headquarters at Spokane, Wash., has been promoted to general master mechanic of the lines west of Paradise, Mont., with headquarters at Tacoma, Wash.

J. E. STONE has been appointed assistant master mechanic of the Southern Pacific, with headquarters at Sparks, Nev., succeeding Paul Jones, who has resigned.

C. A. WIRTH, road foreman of engines on the Northern Pacific, with headquarters at Pasco, Wash., has been appointed master mechanic, with the same headquarters, succeeding G. F. Egbers.

CHARLES F. PARSONS, whose appointment as general master mechanic, of District No. 1, of the New York Central at Albany, N. Y., was announced in last month's issue, was born February 14, 1876, at Ilion, N. Y., and received his education in the grammar schools. In June, 1889, he entered the employ of the West Shore at Frankfort, N. Y., as messenger boy and was transferred to the store department in the fall of 1890. In the fall of 1892 he entered the locomotive department as a machinist apprentice. On the completion of his apprenticeship he resigned to accept a position as machinist with the New York, Ontario & Western, remaining with that company until November, 1896, when he returned to the West Shore as a locomotive fireman. In November, 1902, he was promoted to engineman and in April, 1910, to road foreman of engines on the Mohawk division. He became master mechanic of the Mohawk division on July 1, 1918.

Charles F. Parsons

JOHN F. LONG, district maintenance of equipment inspector of the Baltimore & Ohio, has been appointed master mechanic of the Connellsville division, Eastern district, with headquarters at Connellsville, Pa., succeeding H. J. Burkley, assigned to other duties Captain Long served in France during the recent war in the capacity of inspector of equipment at Santes, France, master mechanic of the Paris & Mediterranean Railroad at Nimes Garde, France, and master mechanic at San Sulpice, and was commander of the 395th Casual Company, 35th Engineers. Previously he was employed on the St. Louis-San Francisco as machinist, assistant foreman, division foreman, general foreman, master mechanic and shop superintendent, and was for eight months with the United States Railroad Administration as assistant supervisor of equipment.

J. F. Long

SHOP AND ENGINEHOUSE

C. M. JACOBSON, shop superintendent of the Seaboard Air Line, with headquarters at Jacksonville, Fla., has been transferred to Portsmouth, PVa., succeeding B. E. Greenwood, assigned to other duties.

F. W. KNOTT, master mechanic of the Alabama division of the Seaboard Air Line, with headquarters at Savannah, Ga., has been appointed shop superintendent at Jacksonville, Fla., to succeed C. M. Jacobson.

SUPPLY TRADE NOTES

Willaim S. Noble has been appointed manager of the railroad department of the Standard Paint Company, with offices in the Woolworth building, New York, and Plymouth building, Chicago.

George B. Malone, general manager of the K-G Welding & Cutting Company, New York, has also assumed the duties of district manager of the Philadelphia territory and has his office at 929 Chestnut street, Philadelphia, Pa.

Julius Janes, formerly president of the Standard Steel Castings Company, Cleveland, Ohio, has recently become associated with the Farrell-Cheek Steel Foundry Company, Sandusky, Ohio, as sales representative in Cleveland and Cuyahoga county.

The Mono Corporation of America announces the removal of its main office from Buffalo, N. Y., to 25 West Broadway, New York city, where a complete line of the automatic gas analyzing instruments manufactured by this corporation will be displayed.

A. B. Way, until recently secretary and general manager of the Bridgeport Chain Company, has become affiliated with the Chain Products Company, Cleveland, Ohio, in the capacity of district sales manager for New England, with headquarters at New York.

The Rogatchoff Company, 205 Water street, Baltimore, Md., has recently been incorporated under the laws of Maryland, with a capital of $50,000, to manufacture adjustable crossheads for locomotives. A E. Davis is president, Theodore Rogatchoff is vice-president and H. V. Baker, secretary and treasurer.

William N. Thornburgh, Inc., and the Drexel Sash & Door Company, Chicago, have been consolidated and are now known as the W. N. Thornburgh Manufacturing Company, manufacturers of Thornburgh dust guards. The new plant and offices are located at Fiftieth avenue and Thirty-second street, Cicero, Ill.

New offices have been opened by the American Rolling Mill Company, Middletown, Ohio, in the Hibernia Bank building, New Orleans, La., to cover the southern states, including Texas, excepting El Paso. The office will be in charge of C. C. Lynd, who has represented the American Rolling Mill Company at Atlanta, Ga., for several years past.

The Oxweld Acetylene Company, New York, has established Pacific Coast sales and distributing headquarters at San Francisco, with offices at 1077 Mission street. Additional sales representatives' offices are maintained at the following points: Los Angeles, Salt Lake City, Portland, Seattle. Leo Romney is Pacific sales manager, with headquarters at San Francisco.

The Mesta Machine Company, Pittsburgh, Pa., has opened an office in the Singer building, New York, from which point all its foreign business will be handled. The New York office will also be the sales office for the New York and Eastern states territory. M. M. Moore, the export sales manager, who has just returned from a several months' European trip, will be in charge.

Arthur Jackson, formerly of the Gould, Shapley & Muir Company, Brantford, Ont., has been appointed Potter & Johnston representative with the Yamatake Company of Tokio, Japanese agents for the Potter & Johnston Machine Company, Pawtucket, R. I. Mr. Jackson was at one time employed by the Jones & Lamson Company, Springfield, Vt., but for the past five years has been demonstrating and selling Gridley automatics in Great Britain.

A large interest in the Youngstown Steel Car Company, Youngstown, Ohio, has been acquired by the Youngstown Sheet & Tube Company, and the Brier Hill Steel Company, both of Youngstown. The plant represents an investment of about $1,000,000 and will be used chiefly for repair work. It is intended later to erect additional works for the building of steel cars complete and plans have been outlined for a plant to cost at least $5,000,000.

The Uehling Instrument Company, 71 Broadway, New York, manufacturer of fuel economy equipment, announces that it is now being represented in the New England states by the Smith Engineering & Supply Company, 89 State street, Boston, Mass., manufacturers' agents and engineers, specializing in power plant equipment. S. W. Smith, president of the latter company, was until very recently associated with the Uehling Instrument Company, with headquarters in its New York office.

M. E. Hamilton has become associated with the Automatic Straight Air Brake Company as field engineer. The company has started to build up its field organization to take care of the brake installations which it will soon be making. Mr. Hamilton entered railroad service on the C. K. & N. Railway (construction company of the Chicago, Rock Island & Pacific) in the fall of 1887 as fireman. Early in 1890 he entered the service of the Atchison, Topeka & Santa Fe as a brakeman, and in 1891 was promoted to conductor at Galveston, Tex. From the fall of 1901 he worked for the Galveston, Houston & Henderson as engineer and roundhouse fore-man until 1903, when he went back to the Santa Fe as engineer. In 1906 he was made air brake insructor; in 1909 he was made general air brake insructor of the system with headquarters at Topeka, where he remained until 1911, when he became railroad representative for the Garlock Packing Company. He re-entered railroad service as general air brake inspector for the St. Louis-San Francisco in 1915 and in 1919 resigned to enter government service as field inspector for the Bureau of Safety, Inetrstate Commerce Commission.

M. E. Hamilton

The Heald Machine Company, Worcester, Mass., announces two recent changes in organization. W. A. Erickson, who has been demonstrating and selling in the New York district, has been made district sales manager in Buffalo and will open a branch office at a location as yet undecided upon. S. M. Hershey has resigned as sales manager at Philadelphia and his position will now be held by A. Sleath, who has been representing the Heald Machine Company in the south.

The Bourne-Fuller Company, Cleveland, Ohio, and the Upson Nut Company, Cleveland, Ohio, have effected a consolidation under the name of the Bourne-Fuller Company,

Cleveland, Ohio. The ownership and management of these companies has been identical for the past eight years. The Upson Nut Company plants will continue operation as the Upson Works of the Bourne-Fuller Company, the product of its nut and bolt departments being marketed under the same trade-marks as in the past.

George E. Long, senior vice-president of the Joseph Dixon Crucible Company, Jersey City, N. J., following his re-election as a member of the board of directors at the annual meeting, announced his decision to retire from the office of vice-president after 43 years of active service with this company, having begun as stenographer and advanced to the offices of secretary, treasurer and vice-president, respectively. He has taken an active part in the introduction of graphite as a lubricant and of silica-graphite paint.

H. A. Noble, vice-president of the Pittsburgh Spring & Steel Company, Pittsburgh, Pa., has been elected president to succeed D. C. Noble, deceased. S. F. Krauth, secretary and assistant treasurer, has been elected vice-president and treasurer, with headquarters at Pittsburgh. J. N. Brownrigg, eastern sales agent at New York, has been elected vice-president and eastern representative at New York, and M. F. Ryan, western sales agent at Chicago, has been elected vice-president and western representative, with headquarters at Chicago.

The personnel of the railway department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been rearranged and promotions have been made as follows: W. R. Steinmetz, manager of the heavy traction section, with Franklin W. Carter in charge of both foreign and domestic negotiations; E. D. Lynch, manager of the light traction equipment section, with George Skipton in charge of negotiations; J. L. Crouse, manager of the new railway apparatus and supply section, and K. A. Simmon, manager of the safety car and foreign railway equipment section.

Robert M. Gates has been appointed managing engineer in charge of the Philadelphia, Pa., district of the Lakewood Engineering Company, Cleveland Ohio, with offices at 1034 Widener building, Philadelphia. Mr. Gates is a graduate of Purdue University. He has been active in organizing the Material Handling Section of the American Society of Mechanical Engineers, and is acting as chairman of that section during its period of organization. He has devoted the past 12 years to the design, application and engineering surveys of mechanical means of conserving labor in the construction, industrial and transportation fields.

The sales, purchasing, accounting and executive departments of the Reed-Prentice Company, Worcester, Mass., Becker Milling Machine Company, Hyde Park, Mass., and Whitcomb-Blaisdell Machine Tool Company, Worcester, Mass., were recently combined and the main offices are now permanently located at 53 Franklin street, Boston, Mass. The various agencies throughout the United States that formerly handled the products of these factories are now displaced by direct factory branches in the various machine tool centers of the United States, and the three companies now have combined sales branches in Boston, Worcester, New York, Detroit, Chicago, Cleveland, and Indianapolis. The locations of the various offices are as follows: Boston, 53 Franklin street, executive office; Worcester, Reed-Prentice Company, Cambridge street; Whitcomb-Blaisdell Machine Tool Company, 134 Gold street; Hyde Park, Boston, Becker Milling Machine Company; New York, fifth floor, Grand Central Palace; Chicago, 26-28 North Clinton street; Detroit, 408 Kerr building, corner Fort and Beaubien streets; Cleveland, 408 Frankfort avenue; Indianapolis, 940 Lemcke annex.

TRADE PUBLICATIONS

HARDENING ROOM EQUIPMENT AND SUPPLIES.—The Waisner Manufacturing Company, Rockford, Ill., has issued a 12-page booklet describing its line of lead hardening furnaces, lead furnace preheating attachments, coke furnaces, carbonizing pots and carbonizing material.

LOCOMOTIVES FOR LOGGING SERVICE.—Record No. 96, published by the Baldwin Locomotive Works, Philadelphia, Pa., describes the conditions which must be met by locomotives in logging service and recommends types that are best suited for the purpose. Numerous locomotives built for this kind of service are illustrated and general data are given for each.

VANADIUM STEEL.—The Vanadium Alloys Steel Company, Pittsburgh, Pa., has issued a small booklet covering Vasco vanadium steel, a general utility tool steel for all purposes, particularly adapted to resist shock and strain. This steel is made in six different types, each containing a different percentage of carbon. The classes of work for which each is especially suited are listed and directions are given for the heat treatment of each type.

GAGES.—A new gage catalogue has been issued by the Greenfield Tap & Die Corporation, Greenfield, Mass. In addition to being a catalogue it contains valuable screw cutting and gaging data, and describes the latest methods in precision measuring and inspection. Graphic tolerance charts to aid in establishing manufacturing limits, and complete gaging systems to assist manufacturers in promoting standardization of their products are also included in the catalogue.

SHOP MACHINERY AND TOOLS.—The Brown & Sharpe Manufacturing Company, Providence, R. I., has revised its catalogue of machinery and tools. The new catalogue, known as No. 137, contains 609 pages, 5¾ in. by 3½ in., and is illustrated. It covers the complete line of equipment manufactured by this company, including milling and grinding machines, automatic gear cutting and screw machines, cutters, machinists' and test tools, and contains a number of tables for the convenience of mechanics.

SUPERHEATERS.—Bulletin T-5, published by the Locomotive Superheater Company, New York, describes the advantages of superheated steam for stationary power plants and presents the engineering reasons for these advantages from a new angle. The argument is clear and concise and should be of interest to all power plant owners and operators in every industry or power plant service. Charts are included showing the effect of superheat on steam consumption, the superheat required to prevent condensation and the increase in thermal efficiency due to superheat.

SURPLUS WAR MATERIAL.—The Way to Increased Production is the title of a booklet issued by the du Pont Chemical Company, Wilmington, Del., giving some facts regarding the sale of surplus war material taken over from the war plants of the du Pont Company. Although the book is not complete as an inventory of the material on hand, it gives an idea of the great variety of supplies for sale, including a large range of articles in daily use, also flat and gondola cars, gasoline and electric storage battery locomotives, steam power equipment, hoists, etc. General machine shop tools of all kinds are on hand, and there is also special machinery built for manufacturing purposes peculiar to the powder business but which can in many instances be used in other industries with slight changes.